AD-A057 156 STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB F/G 8/3
RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN VOYAGE 34.(U)
AUG 78 J F DALZELL N00024-74-C-5451
UNCLASSIFIED SIT-DL-77-1934 SSC-SL-7-18 NL

1 OF 2
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SL-7-18

RADAR AND TUCKER WAVEMETER DATA
FROM SEA-LAND McLEAN
VOYAGE 34

SHIP STRUCTURE COMMITTEE
1978

18 SSC

19 SL-7-18

9 TECHNICAL REPORT

on

Project SR-1221

"Correlation and Verification of

Wavemeter Data from the SL-7"

6 RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND McLEAN VOYAGE 34

11 Aug 78

by

10 J. F. Dalzell

Stevens Institute of Technology

12 109 p.

under

Department of the Navy
Naval Ship Engineering Center
Contract No. N00024-74-C-5451

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U.S. Coast Guard Headquarters
Washington, D.C.
1978

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ABSTRACT

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Second Season Voyage 34.

CONTENTS

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INTRODUCTION

It was one of the objectives of the SL-7 full-scale instrumentation program to provide a direct instrumental measure of the wave environment so that more precise correlations could be made between full-scale observations, and analytical and model results. To this end the ship was fitted with a micro-wave radar relative wave meter and various motion sensing devices. A "Tucker Meter" pressure actuated wave height sensing system was also installed.

The purpose of the present project is to reduce and analyze the resulting radar and Tucker meter data obtained on the SEA-LAND McLEAN in the second (1973-1974) and third (1974-1975) winter recording seasons. The purpose of the present report is to present the reduced data from the Second Season Voyage 34.

BACKGROUND

Since the purpose of the present report is only to document a portion of the reduced data, it should be noted that details of the experiments themselves, and of the analyses leading up to the present results, are contained elsewhere. To be specific, References 1 and 2 contain, for both recording seasons in question, a full account of the instrumentation, basic recording, and the nominal circumstances surrounding the present data. References 3 and 5 contain the detail of the reduction of the original data to digital form. Reference 4 contains the detail of the analyses and of the procedures used in generating the present results. Finally, Reference 6 contains the summary, discussion and conclusions.

NOTES ON THE CONTENTS

Each voyage leg was processed, and is presented, as a unit. The first part of the presentation for each voyage leg is a four-part table.

Parts a and b of each table contain the log-book data extracted from Ref. 1 or 2. With the exception of the first column of each page, the meaning of each entry is that established by Teledyne Materials Research. The first column is the run number assigned to each interval during the digitization at D.L. This number is retained for identification throughout.

Part c of each table is a comparison of results from the present digitization with that at TMR. Five columns are stress results obtained at TMR. Stresses are presented in thousands of pounds per square inch. The columns marked 6 through 8 are from the present digitization. Column 6 "range of recorded extremes" was computed from the first pass analysis by scaling the extremes in each interval and subtracting the smallest extreme from the largest. Column 7 is $2\sqrt{2}$ times the process rms. This estimate should compare with the value given by TMR for "rms P to T stress,". Column 8 is the difference of the sample mean of the interval noted, from the sample mean of the first interval digitized in each voyage leg. The remaining columns are various ratios of present results to those obtained by TMR.

Part d of the tables involves indices of the magnitude of raw radar, roll, pitch, vertical and transverse acceleration, and Tucker meter signals. The first index in each case is 4.0 x the rms. The second and third indices are the positive and negative extremes for each channel. The extremes observed for roll and pitch were corrected for electrical zero on tape before scaling. The extremes for all other items were corrected to the sample mean before scaling. The senses of pitch and Tucker meter are not correct for reasons noted in Ref. 4, and it is to be emphasized that all data is raw (uncorrected for anything).

The second part of the presentation for each voyage leg is a series of charts, a pair of charts for each interval. The first of the pair includes plots of spectra of midship vertical bending stress, roll, corrected radar wave elevation, Tucker meter wave, and the mean dynamic head at frame 119. The "mean dynamic head" is a partial correction of the Tucker meter as detailed in Ref. 4. At the left of the first chart is a tabulation of various data; portions of the log book data from the tables, two indices of midship stress, a summary of the magnitude of motions,

and finally a table summarizing wave height statistics obtained from spectra as well as peak-trough analyses of the time histories.

The second chart of the pair for each interval are sample time histories for five of the channels of information treated in the first chart. As noted in Reference 4, there was at the end of data reduction 16-1/2 minutes of valid radar wave elevation data. To produce the charts an 8-1/2 minute portion of this sample was selected.

A fuller discussion of the background and conventions employed in the charts is presented in the Appendix.

REFERENCES

1. Wheaton, J.W. and Boentgen, R.R., "Second Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," SL-7-9, 1976, AD-A034162.

2. Boentgen, R.R., "Third Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," SL-7-10, 1976, AD-A034175.

3. Dalzell, J.F., "Original Radar and Standard Tucker Wavemeter SL-7 Containership Data Reduction and Correlation Sample," SSC-277, SL-7-14. 1978.

4. Dalzell, J.F., "Wavemeter Data Reduction Method and Initial Data for the SL-7 Containership," SSC-278, SL-7-15. 1978.

5. Dalzell, J.F., "Modified Radar and Standard Tucker Wavemeter SL-7 Containership Data," SSC-279, SL-7-20. 1978.

6. Dalzell, J.F., "Results and Evaluation of the SL-7 Containership Radar and Tucker Wavemeter Data," SSC-280, SL-7-23. 1978.

TABLE Ia

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
1009	157	3	9	01-29-74	2400			082	32.3	132.0	29.80	45/45
1013	157	4	13	01-30-74	0400			089	32.2	131.7	30.10	45/45
1017	157	5	17	01-30-74	0800			087	32.3	132.0	30.06	64/49
1021	157	6	21	01-30-74	1200	40-31 N	59-02 W	090	32.3	131.8	30.11	65/52
1026	157	7	26	01-30-74	1600	40-31 N	59-02 W	090	32.1	131.3	30.08	59/55
1029	157	8	29	01-30-74	2000	40-31 N	59-02 W	090	32.2	131.8	30.02	58/52
1033	157	9	33	01-30-74	2400	40-31 N	59-02 W	090	32.1	131.5	30.00	66/60
1037	157	10	37	01-31-74	0400	40-31 N	59-02 W	090	31.9	130.1	30.00	65/55
1041	157	11	41	01-31-74	0800	40-31 N	59-02 W	090	32.2	131.7	30.00	34/44
1045	157	12	45	01-31-74	1200	40-59 N	43-08 W	090	32.6	133.1	30.05	57/52
1049	157	13	49	01-31-74	1600	40-59 N	43-08 W	073	32.3	132.2	30.06	60/55
1101	159	14	1	01-31-74	2000	40-59 N	43-08 W	073	32.1	131.0	30.10	57/48
1105	159	15	5	01-31-74	2400	40-59 N	43-08 W	073	32.3	132.2	30.10	56/46
1109	159	16	9	02-01-74	0400	40-59 N	43-08 W	073	31.8	130.0	30.09	55/45
1113	159	17	13	02-01-74	0800	40-59 N	43-08 W	073	32.3	132.0	30.05	54/47
1117	159	18	17	02-01-74	1200	44-27 N	27-18 W	072	32.3	132.0	30.09	53/60
1122	159	19	22	02-01-74	1600	44-27 N	27-18 W	072	32.4	132.6	30.00	53/50
1125	159	20	25	02-01-74	2000	44-27 N	27-18 W	072	32.3	132.0	29.89	52/54
1129	159	21	29	02-01-74	2400	44-27 N	27-18 W	072	32.6	133.0	29.75	52/50
1134	159	22	34	02-02-74	0400	44-27 N	27-18 W	071	32.4	132.5	29.62	52/45
1137	159	23	37	02-02-74	0800	44-27 N	27-18 W	071	32.6	133.0	29.57	51/47
1141	159	24	41	02-02-74	1200	48-10 N	10-20 W	071	32.3	132.0	29.61	51/48
1145	159	25	45	02-02-74	1600	48-10 N	10-20 W	071	32.1	131.2	29.75	53/44
1149	159	26	49	02-02-74	2000	48-10 N	10-20 W	071	32.2	131.6	29.80	50/47

TABLE Ib

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
1009	2	172P/ 5	172P	1	172P	2	150	CLEAR /
1013	2	179P/ 5	179P	1	179P	3	150	CLEAR /
1017	2	19P/ 5	19P	1	177P	4	150	OCAST /
1021	2	0 / 5	0	2	180	4	150	OCAST /
1026	3	11S/ 8	11S	2	180	5	150	OCAST /
1029	3	11S/ 8	11S	2	180	5	150	OCAST /
1033	4	45S/12	45S	2	180	5	150	OCAST /
1037	4	22S/12	22S	2	180	5	150	OCAST /
1041	3	11S/10	11S	2	180	5	150	OCAST /
1045	2	11S/ 5	11S	3	180	8	150	PT CLDY /
1049	2	95P/ 5	95P	2	152S	8	150	PT CLDY /
1101	2	50P/ 5	50P	2	152S	8	150	PT CLDY /
1105	4	95P/12	95P	2	152S	8	150	PT CLDY /
1109	4	95P/15	95P	2	107S	8	150	PT CLDY /
1113	4	118P/15	118P	2	107S	8	150	PT CLDY /
1117	5	117P/20	117P	3	63S	8	150	PT CLDY /
1122	7	151P/30	151P	4	63S	8	150	PT CLDY /
1125	7	117P/30	117P	4	63S	6	150	PT CLDY /
1129	7	175S/30	175S	4	63S	6	150	PT CLDY /
1134	5	161P/20	161P	4	64S	8	150	OCAST /
1137	3	161P/10	161P	4	64S	8	150	OCAST /
1141	5	64S/20	64S	3	64S	6	150	OCAST /
1145	5	154S/20	154S	3	64S	8	150	OCAST /
1149	3	154S/10	154S	1	64S	1	300	PT CLDY /

TABLE Ic

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

	TMR RESULTS					D.L. DIGITIZATION			COLUMN RATIOS		
D.L. RUN NO.	NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	(7) / (4)	(6) / (3+5)	(6) / (3)
1009	109	0	2.79	1.15	0.00	3.18	1.40	-1.93	1.21	1.14	1.14
1013	86	0	3.74	1.54	0.00	4.21	1.85	-1.83	1.20	1.12	1.12
1017	95	0	3.74	1.61	0.00	5.33	2.27	-2.22	1.41	1.42	1.42
1021	109	0	2.15	1.12	0.00	4.26	1.69	1.53	1.51	1.99	1.99
1026	93	0	2.77	1.43	0.00	5.05	2.12	1.39	1.48	1.82	1.82
1029	108	0	3.40	1.47	0.00	4.95	1.96	1.40	1.33	1.46	1.46
1033	127	19	4.25	1.67	1.05	4.70	2.04	0.33	1.22	0.89	1.11
1037	128	13	3.73	1.86	0.97	5.44	2.24	0.68	1.21	1.16	1.46
1041	128	2	4.52	2.27	0.67	5.88	2.61	0.59	1.15	1.13	1.30
1045	142	21	7.44	3.53	1.91	8.90	3.78	0.74	1.07	0.95	1.20
1049	108	0	4.84	2.41	0.00	8.37	3.15	0.96	1.30	1.73	1.73
1101	108	8	7.71	2.75	1.14	7.72	3.28	0.91	1.19	0.87	1.00
1105	105	12	5.34	2.71	1.20	9.37	3.67	0.69	1.35	1.43	1.76
1109	106	15	6.36	2.92	1.42	8.80	3.92	0.87	1.34	1.13	1.38
1113	109	11	6.58	2.84	1.02	8.04	3.48	0.82	1.23	1.06	1.22
1117	93	10	8.77	2.77	1.58	8.31	3.32	1.50	1.20	0.80	0.95
1122	94	3	7.28	2.94	1.43	9.37	3.94	1.64	1.34	1.08	1.29
1125	69	1	6.41	3.26	0.75	9.83	4.00	1.78	1.23	1.37	1.53
1129	90	0	6.92	2.84	0.00	9.35	3.80	2.04	1.34	1.35	1.35
1134	79	4	8.04	3.38	0.89	7.64	3.85	1.73	1.14	0.86	0.95
1137	64	1	6.50	2.98	8.74	9.20	3.65	1.80	1.22	0.60	1.41
1141	48	0	6.92	3.54	0.00	7.88	4.30	1.90	1.22	1.14	1.14
1145	49	0	7.71	3.90	0.00	9.47	4.43	1.86	1.14	1.23	1.23
1149	24	0	4.32	2.86	0.00	5.46	3.39	1.89	1.19	1.27	1.27

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TABLE Id

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 EAST

D.L.	<--- RADAR	--->		<--- ROLL	---->		<--- PITCH	--->		<--VERT ACCEL	->		<--LAT ACCEL	-->		<-- TUCKER	-->	
RUN	4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES		4.0 (RMS)	RECORDED EXTREMES	
NO.	FT	FT	FT	DEG	DEG	DEG	DEG	DEG	DEG	(G)	(G)	(G)	(G)	(G)	(G)	FT	FT	FT
1009	14.	13.	-12.	5.9	5.	-4.	0.5	-0.0	-1.1	0.10	0.1	-0.1	0.14	0.1	-0.1	2.	2.	-2.
1013	21.	21.	-14.	9.9	5.	-12.	0.5	-0.1	-1.2	0.10	0.1	-0.1	0.22	0.2	-0.2	6.	7.	-3.
1017	21.	16.	-18.	9.1	5.	-10.	0.5	0.0	-1.2	0.10	0.1	-0.1	0.21	0.2	-0.2	4.	5.	-3.
1021	14.	16.	-12.	6.0	2.	-7.	0.4	-0.1	-1.0	0.08	0.1	-0.1	0.13	0.1	-0.1	3.	3.	-2.
1026	19.	24.	-18.	8.9	5.	-10.	0.5	0.1	-1.1	0.10	0.1	-0.1	0.19	0.2	-0.2	4.	4.	-3.
1029	18.	14.	-16.	8.2	4.	-9.	0.5	0.1	-1.2	0.12	0.1	-0.1	0.18	0.2	-0.2	4.	4.	-2.
1033	18.	16.	-12.	7.2	3.	-10.	0.7	0.1	-1.2	0.15	0.1	-0.1	0.16	0.2	-0.1	4.	4.	-3.
1037	21.	19.	-22.	9.1	6.	-10.	0.8	0.3	-1.4	0.19	0.2	-0.2	0.20	0.2	-0.2	4.	4.	-4.
1041	22.	18.	-17.	8.0	5.	-7.	1.0	0.5	-1.6	0.24	0.2	-0.2	0.18	0.1	-0.2	5.	4.	-4.
1045	30.	27.	-26.	9.4	8.	-9.	1.6	1.1	-1.9	0.39	0.3	-0.3	0.22	0.2	-0.2	6.	4.	-6.
1049	25.	21.	-19.	12.1	8.	-10.	1.1	0.6	-1.6	0.26	0.2	-0.2	0.27	0.2	-0.2	5.	5.	-4.
1101	25.	21.	-21.	12.9	9.	-12.	1.1	0.6	-1.6	0.26	0.2	-0.2	0.28	0.3	-0.2	6.	6.	-5.
1105	26.	22.	-22.	13.7	11.	-11.	1.1	0.6	-1.5	0.25	0.2	-0.2	0.30	0.3	-0.3	6.	7.	-5.
1109	26.	22.	-25.	13.8	11.	-10.	1.0	0.4	-1.4	0.23	0.2	-0.2	0.30	0.2	-0.2	6.	5.	-5.
1113	26.	21.	-20.	14.9	12.	-12.	1.1	0.4	-1.6	0.26	0.2	-0.2	0.33	0.3	-0.3	6.	8.	-5.
1117	27.	22.	-20.	16.0	13.	-13.	1.0	0.4	-1.5	0.24	0.2	-0.2	0.35	0.3	-0.3	9.	9.	-5.
1122	27.	20.	-26.	16.2	16.	-12.	0.9	0.5	-1.3	0.23	0.2	-0.2	0.34	0.2	-0.4	8.	7.	-6.
1125	29.	24.	-21.	17.9	15.	-14.	1.0	0.4	-1.6	0.24	0.2	-0.2	0.39	0.3	-0.4	8.	7.	-6.
1129	33.	30.	-23.	18.7	12.	-14.	1.0	0.8	-1.6	0.26	0.3	-0.2	0.41	0.3	-0.3	12.	10.	-7.
1134	30.	23.	-26.	19.8	17.	-17.	1.1	0.6	-1.7	0.26	0.2	-0.2	0.42	0.3	-0.4	14.	10.	-9.
1137	31.	35.	-22.	19.6	17.	-15.	0.8	0.4	-1.1	0.18	0.2	-0.2	0.43	0.3	-0.4	15.	11.	-10.
1141	30.	23.	-22.	21.3	18.	-15.	0.7	0.2	-1.2	0.14	0.1	-0.1	0.46	0.3	-0.4	17.	11.	-8.
1145	34.	34.	-20.	23.1	17.	-17.	0.8	0.2	-1.3	0.10	0.1	-0.1	0.51	0.4	-0.4	16.	11.	-11.
1149	24.	21.	-17.	13.1	8.	-11.	0.8	0.1	-1.1	0.04	0.0	-0.0	0.27	0.2	-0.2	18.	11.	-11.

LOG BOOK DATA	
DATE AND TIME	01-29-74 2400
POSITION	
COURSE AND SPEED	082 , 32.3 KNOTS
SEA STATE	2
WAVE HEIGHT	1 FEET
" REL DIR	172 PORT
SWELL HEIGHT	2 FEET
" REL DIR	172 PORT

---- VISUAL WEATHER / COMMENTS ----

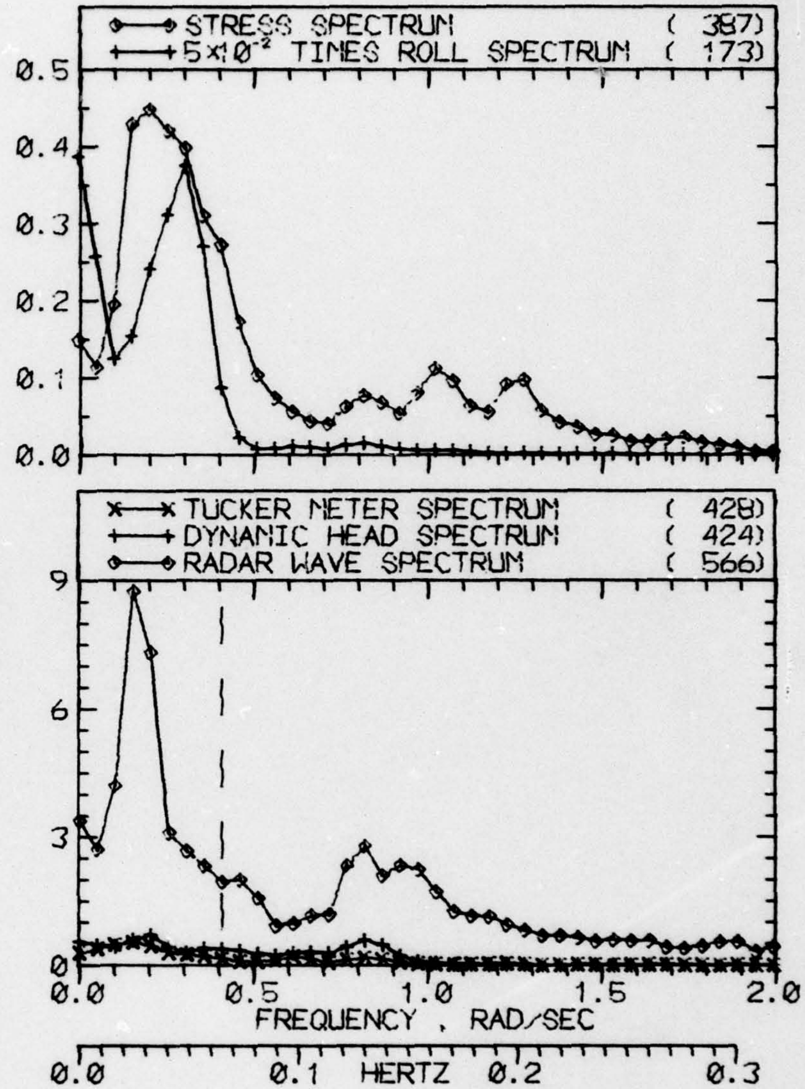
CLEAR /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	2.8 KPSI
4.0 X RMS	1.9 KPSI

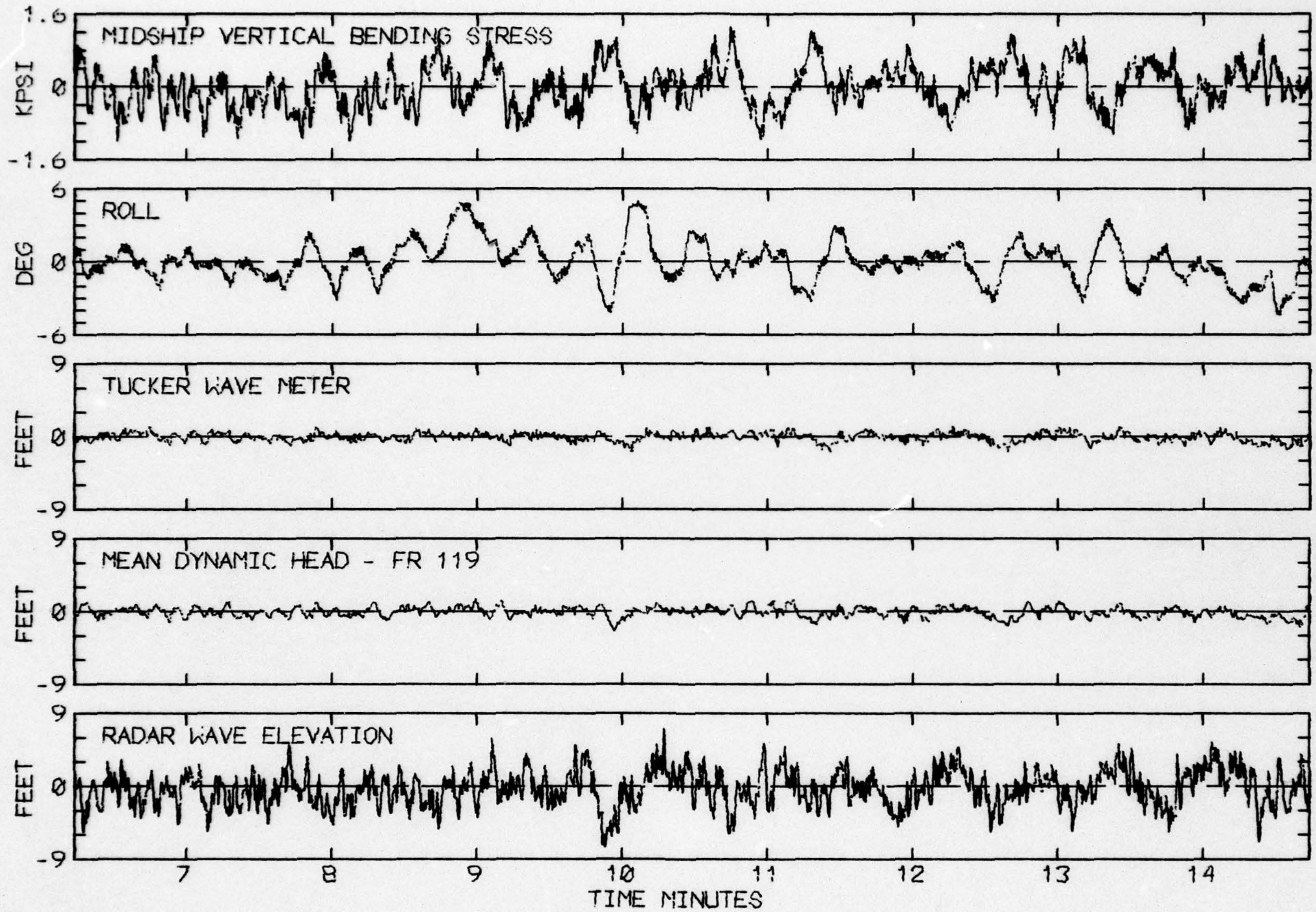
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	6.0 DEG
PITCH	0.48 DEG
DK HSE VERT ACCEL	0.10 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	13.9 FEET
VERTICAL RANGE	10.0 FEET
DISPL AT RADAR	4.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	362	229	352
MAXIMUM HEIGHT	2.5	3.3	9.7
10TH HIGHEST HTS	1.7	2.4	7.3
3RD HIGHEST HTS	1.3	1.8	5.8
4.0 RMS(SPECTRA)	2.1	2.6	8.2



RUN 1009 -- VOYAGE 34E -- TAPE 157 -- INDEX 3 -- INTERVAL 9



RUN 1009 -- VOYAGE 34E -- TAPE 157 -- INDEX 3 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	01-30-74 0400
POSITION	
COURSE AND SPEED	089 , 32.2 KNOTS
SEA STATE	2
WAVE HEIGHT	1 FEET
" REL DIR	179 PORT
SWELL HEIGHT	3 FEET
" REL DIR	179 PORT

---- VISUAL WEATHER / COMMENTS ----

CLEAR /

MIDSHIP VERTICAL BENDING STRESS

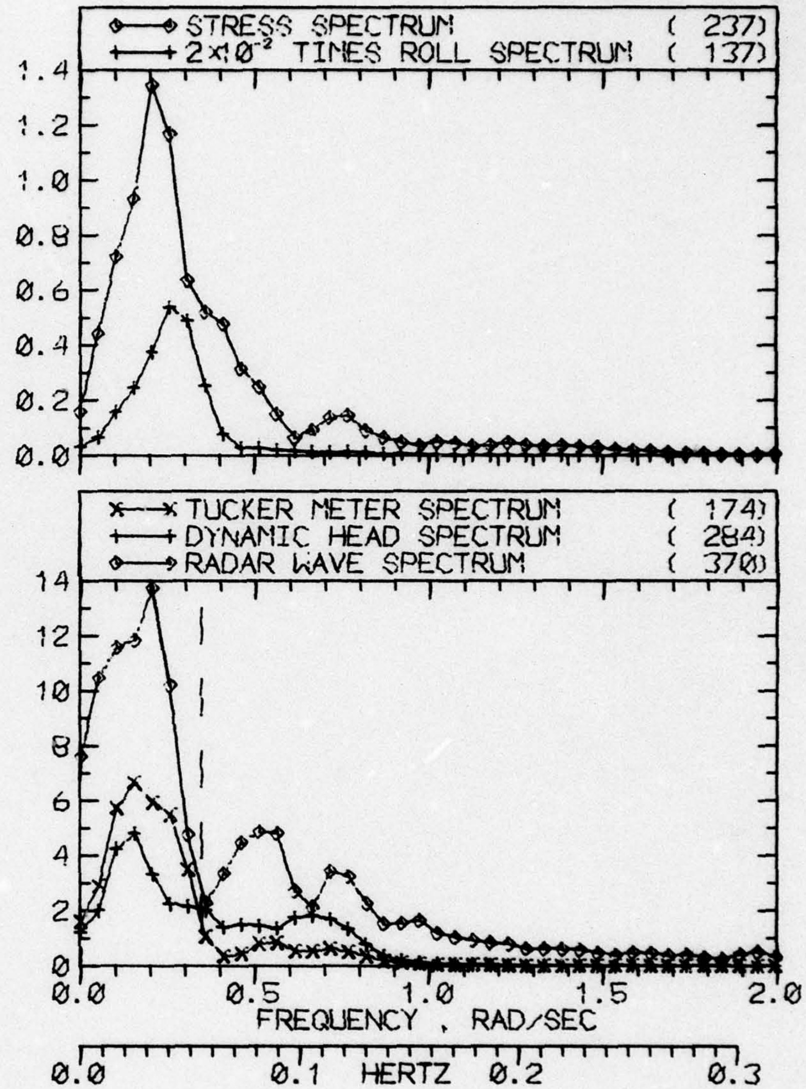
MAXIMUM PK-TR	3.7 KPSI
4.0 X RMS	2.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

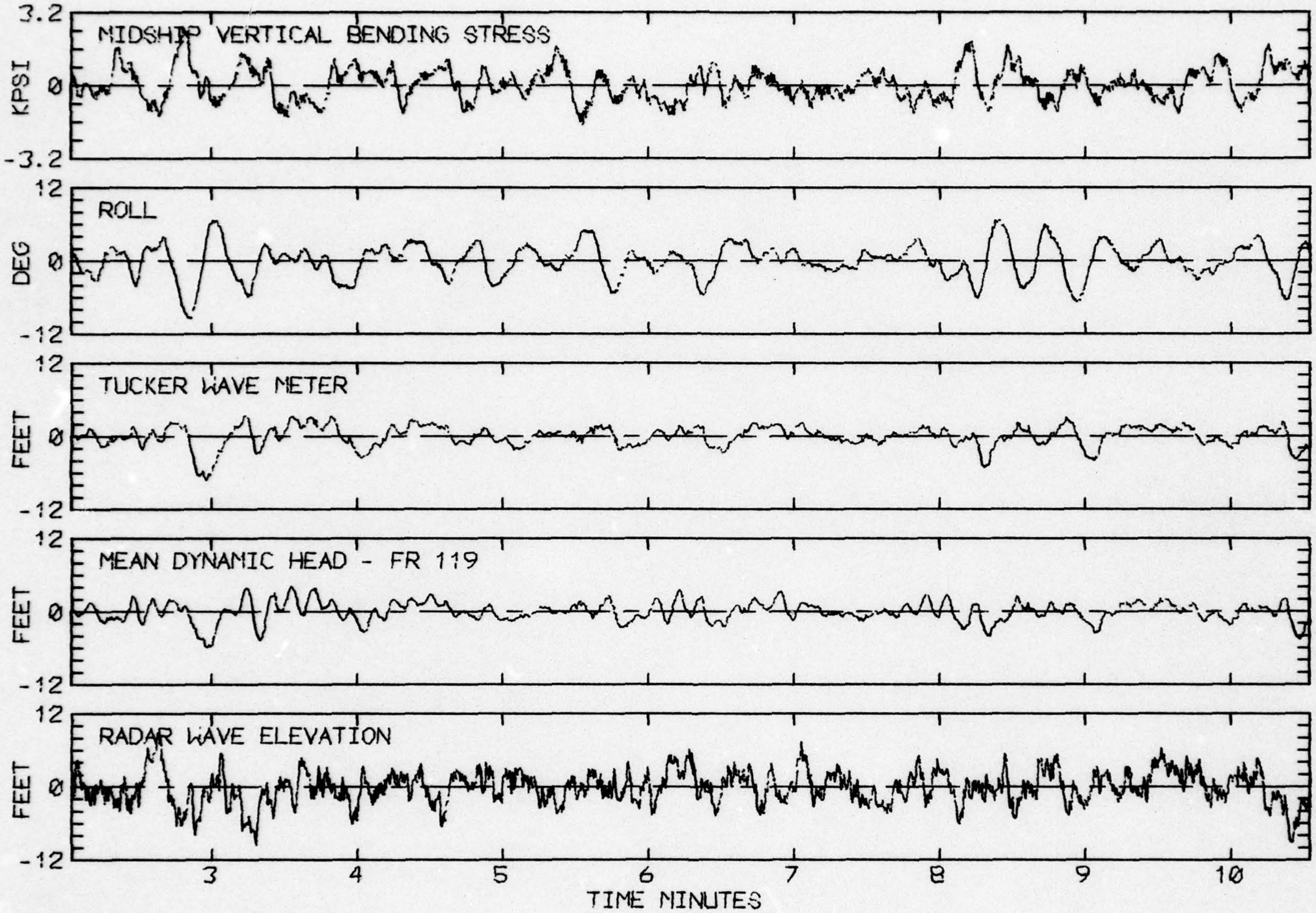
ROLL	9.9 DEG
PITCH	0.46 DEG
DK HSE VERT ACCEL	0.10 G
DK HSE LAT ACCEL	0.22 G
RADAR SLANT RANGE	20.6 FEET
VERTICAL RANGE	12.1 FEET
DISPL AT RADAR	6.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	123	112	229
MAXIMUM HEIGHT	9.6	8.6	15.5
10TH HIGHEST HTS	5.6	5.9	9.0
3RD HIGHEST HTS	3.6	4.3	6.6
4.0 RMS(SPECTRA)	5.6	5.4	10.2



RUN 1013 -- VOYAGE 34E -- TAPE 157 -- INDEX 4 -- INTERVAL 13



RUN 1013 -- VOYAGE 34E -- TAPE 157 -- INDEX 4 -- INTERVAL 13

LOG BOOK DATA

DATE AND TIME	01-30-74 0800
POSITION	
COURSE AND SPEED	087 , 32.3 KNOTS
SEA STATE	2
WAVE HEIGHT	1 FEET
" REL DIR	19 PORT
SWELL HEIGHT	4 FEET
" REL DIR	177 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

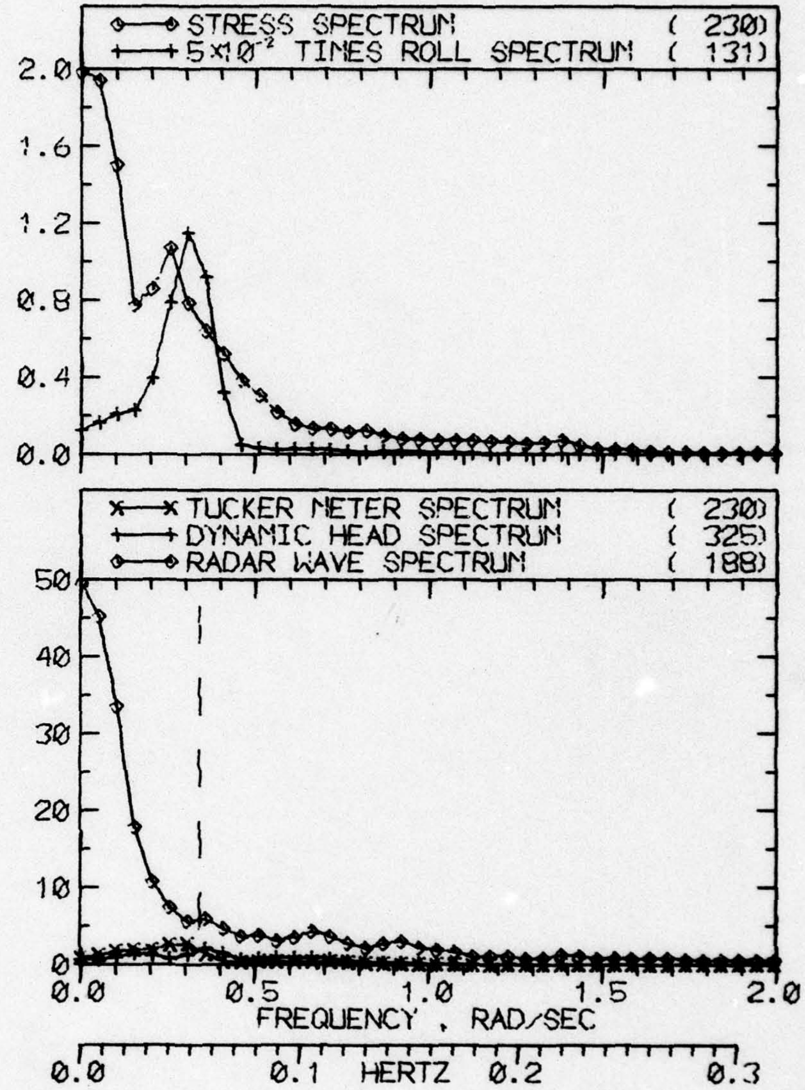
MAXIMUM PK-TR	3.7 KPSI
4.0 X RMS	3.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

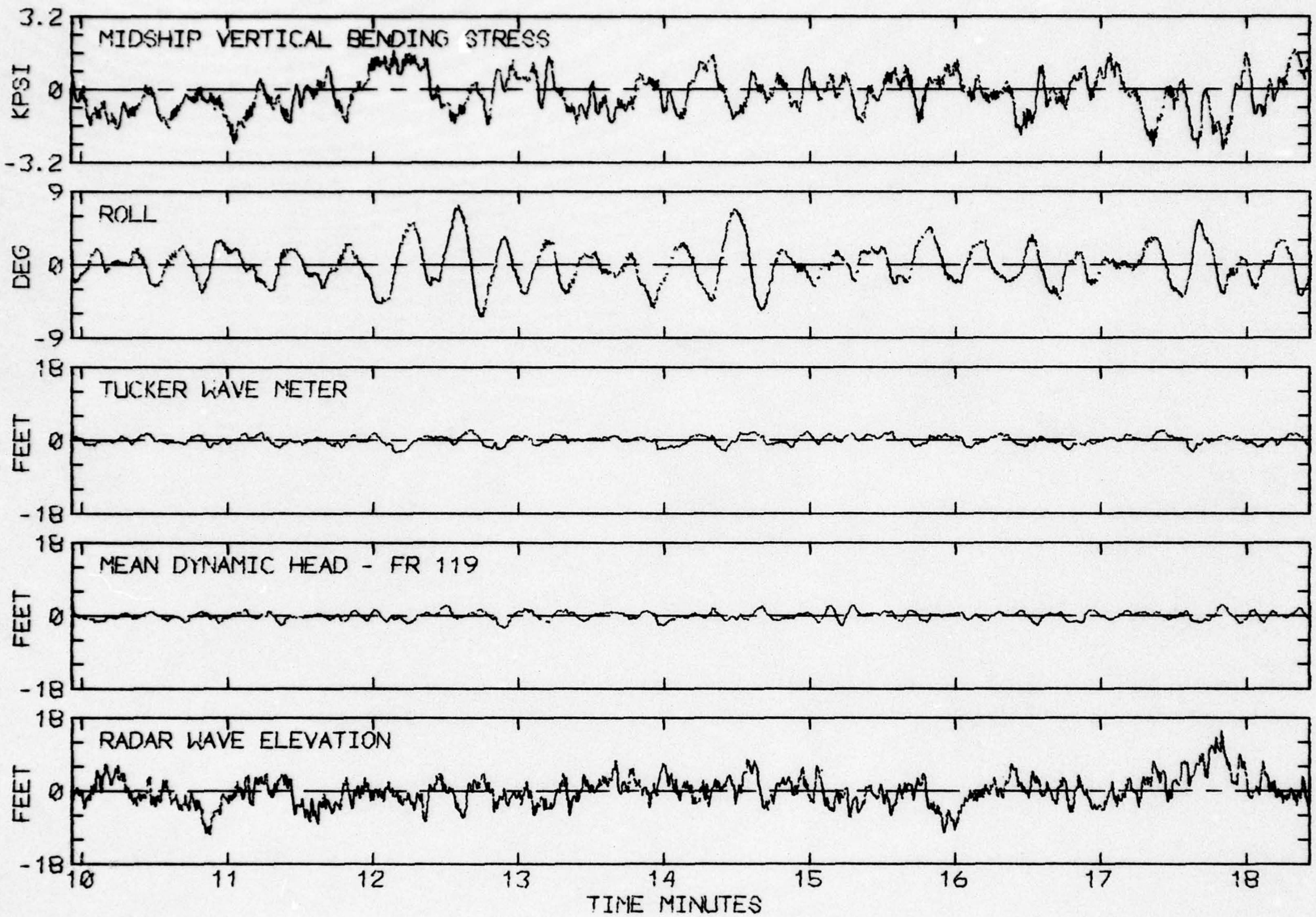
ROLL	8.6 DEG
PITCH	0.50 DEG
DK HSE VERT ACCEL	0.10 G
DK HSE LAT ACCEL	0.21 G
RADAR SLANT RANGE	21.4 FEET
VERTICAL RANGE	14.9 FEET
DISPL AT RADAR	6.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	168	136	181
MAXIMUM HEIGHT	5.0	4.8	16.2
10TH HIGHEST HTS	3.1	3.7	11.2
3RD HIGHEST HTS	2.2	2.9	8.2
4.0 RMS(SPECTRA)	3.9	3.8	13.4



RUN 1017 -- VOYAGE 34E -- TAPE 157 -- INDEX 5 -- INTERVAL 17



RUN 1017 -- VOYAGE 34E -- TAPE 157 -- INDEX 5 -- INTERVAL 17

LOG BOOK DATA	
DATE AND TIME	01-30-74 1200
POSITION	40-31 N 59-02 W
COURSE AND SPEED	090 , 32.3 KNOTS
SEA STATE	2
WAVE HEIGHT	2 FEET
" REL DIR	0
SWELL HEIGHT	4 FEET
" REL DIR	180

---- VISUAL WEATHER / COMMENTS ----

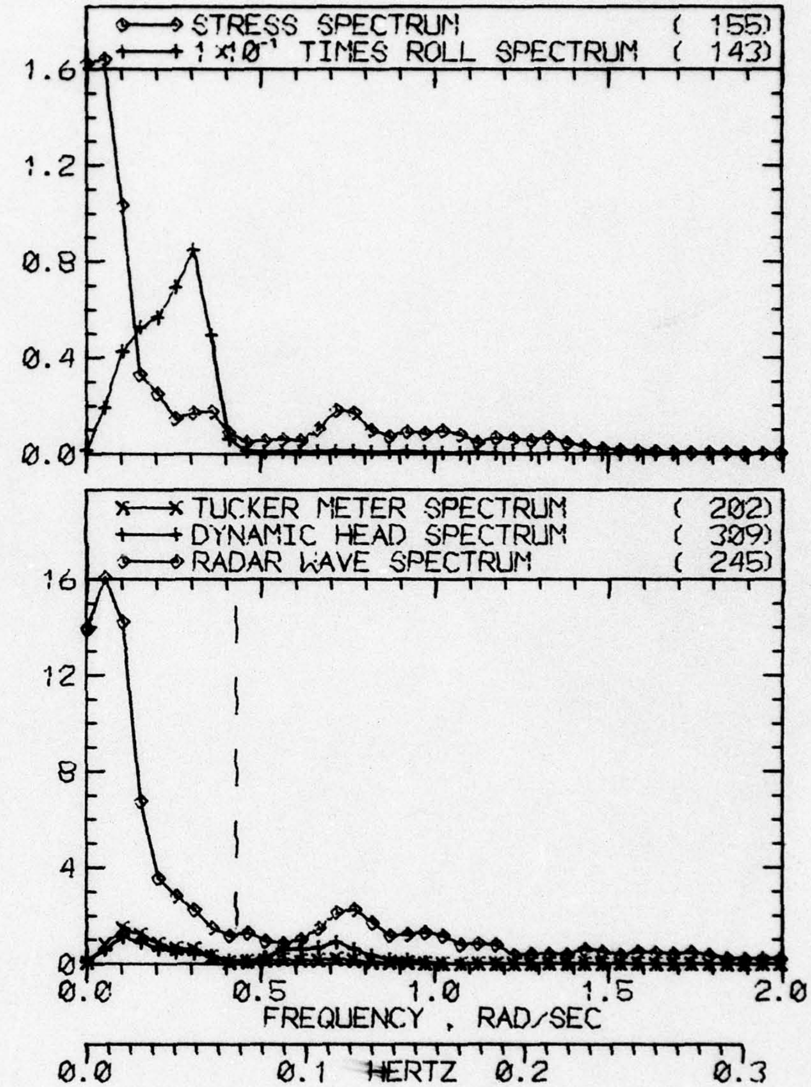
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	2.1 KPSI
4.0 X RMS	2.3 KPSI

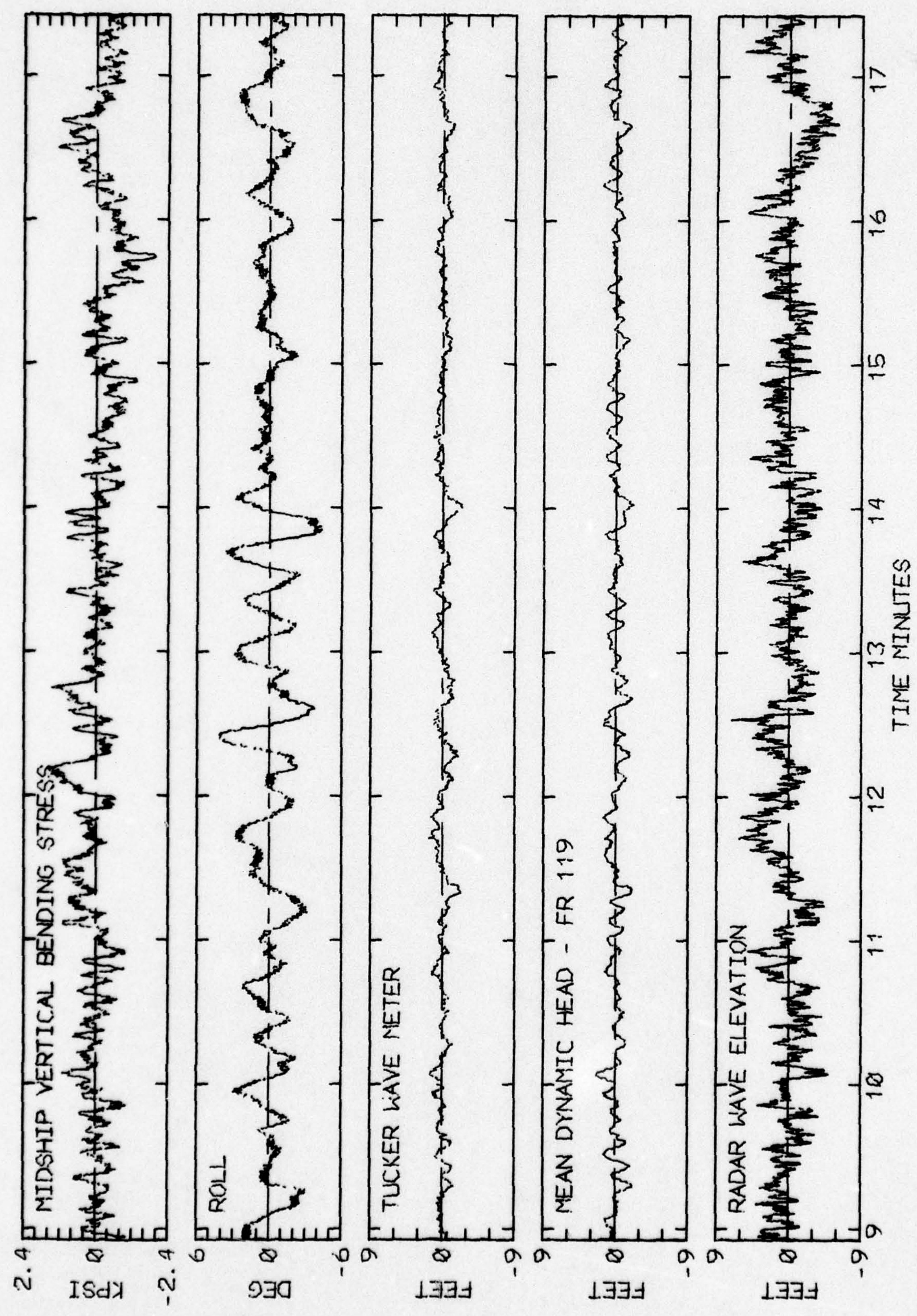
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	5.8 DEG
PITCH	0.42 DEG
DK HSE VERT ACCEL	0.08 G
DK HSE LAT ACCEL	0.13 G
RADAR SLANT RANGE	14.4 FEET
VERTICAL RANGE	10.0 FEET
DISPL AT RADAR	4.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	194	171	271
MAXIMUM HEIGHT	2.7	3.5	10.4
10TH HIGHEST HTS	2.0	2.6	6.7
3RD HIGHEST HTS	1.4	2.0	5.3
4.0 RMS(SPECTRA)	2.5	2.8	8.6



RUN 1021 -- VOYAGE 34E -- TAPE 157 -- INDEX 6 -- INTERVAL 21



RUN 1021 -- VOYAGE 34E -- TAPE 157 -- INDEX 6 -- INTERVAL 21

LOG BOOK DATA	
DATE AND TIME	01-30-74 1600
POSITION	40-31 N 59-02 W
COURSE AND SPEED	090 , 32.1 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	11 STBD
SWELL HEIGHT	5 FEET
" REL DIR	180

---- VISUAL WEATHER / COMMENTS ----

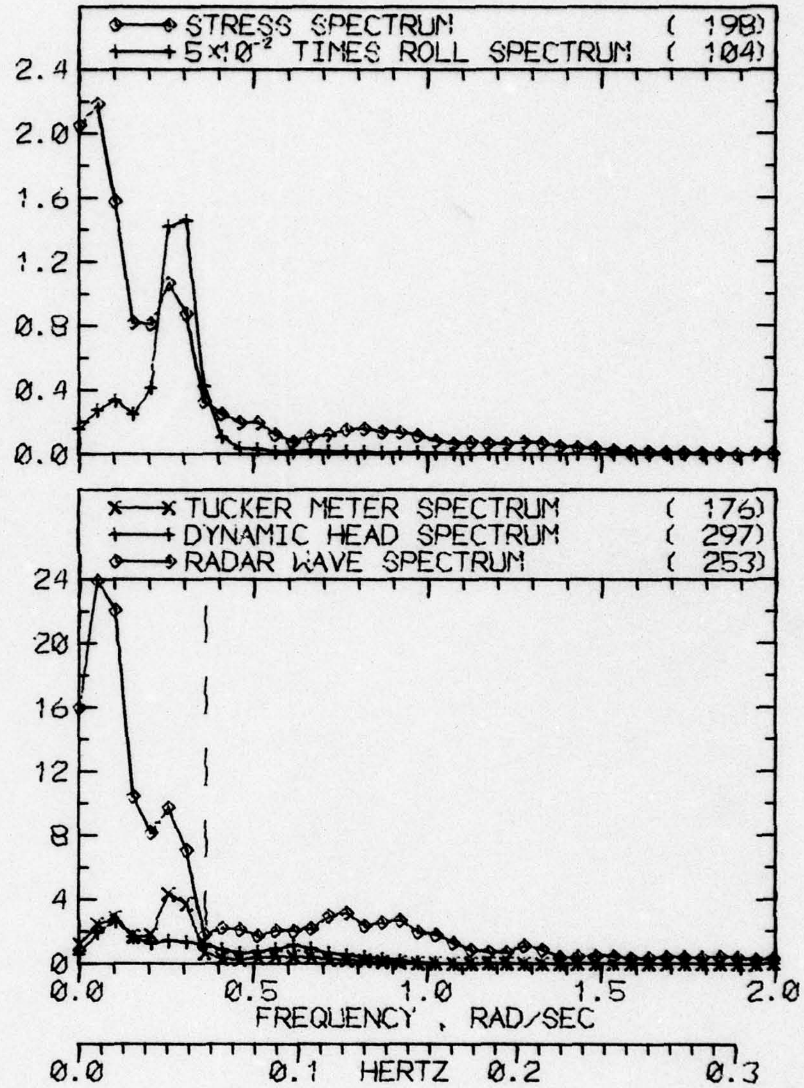
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	2.8 KPSI
4.0 X RMS	3.0 KPSI

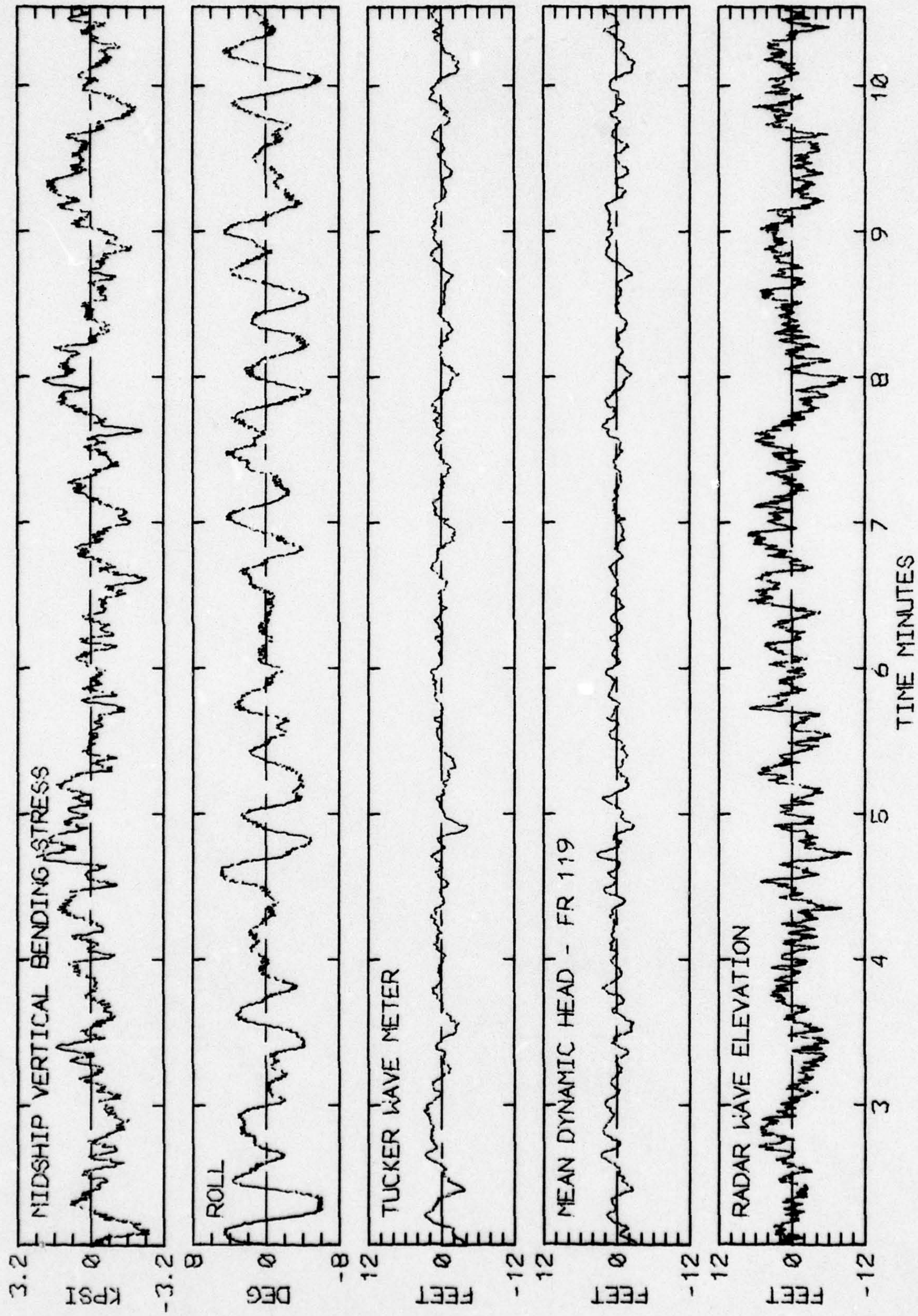
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	9.0 DEG
PITCH	0.50 DEG
DK HSE VERT ACCEL	0.10 G
DK HSE LAT ACCEL	0.19 G
RADAR SLANT RANGE	19.1 FEET
VERTICAL RANGE	12.3 FEET
DISPL AT RADAR	5.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	173	135	245
MAXIMUM HEIGHT	6.4	4.8	10.6
10TH HIGHEST HTS	3.1	3.8	8.4
3RD HIGHEST HTS	2.1	2.7	6.4
4.0 RMS(SPECTRA)	4.3	4.0	10.8



RUN 1026 -- VOYAGE 34E -- TAPE 157 -- INDEX 7 -- INTERVAL 26



RUN 1026 -- VOYAGE 34E -- TAPE 157 -- INDEX 7 -- INTERVAL 26

LOG BOOK DATA

DATE AND TIME	01-30-74 2000
POSITION	40-31 N 59-02 W
COURSE AND SPEED	090 , 32.2 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	11 STBD
SWELL HEIGHT	5 FEET
" REL DIR	180

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

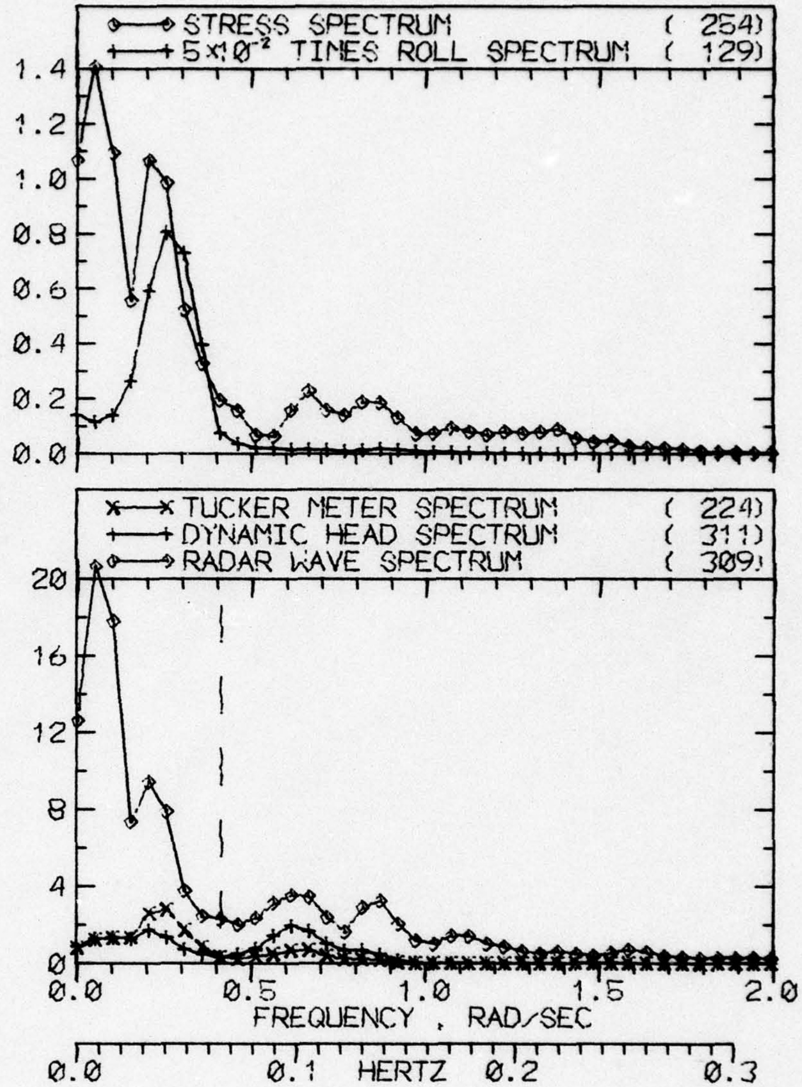
MAXIMUM PK-TR	3.4 KPSI
4.0 X RMS	2.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

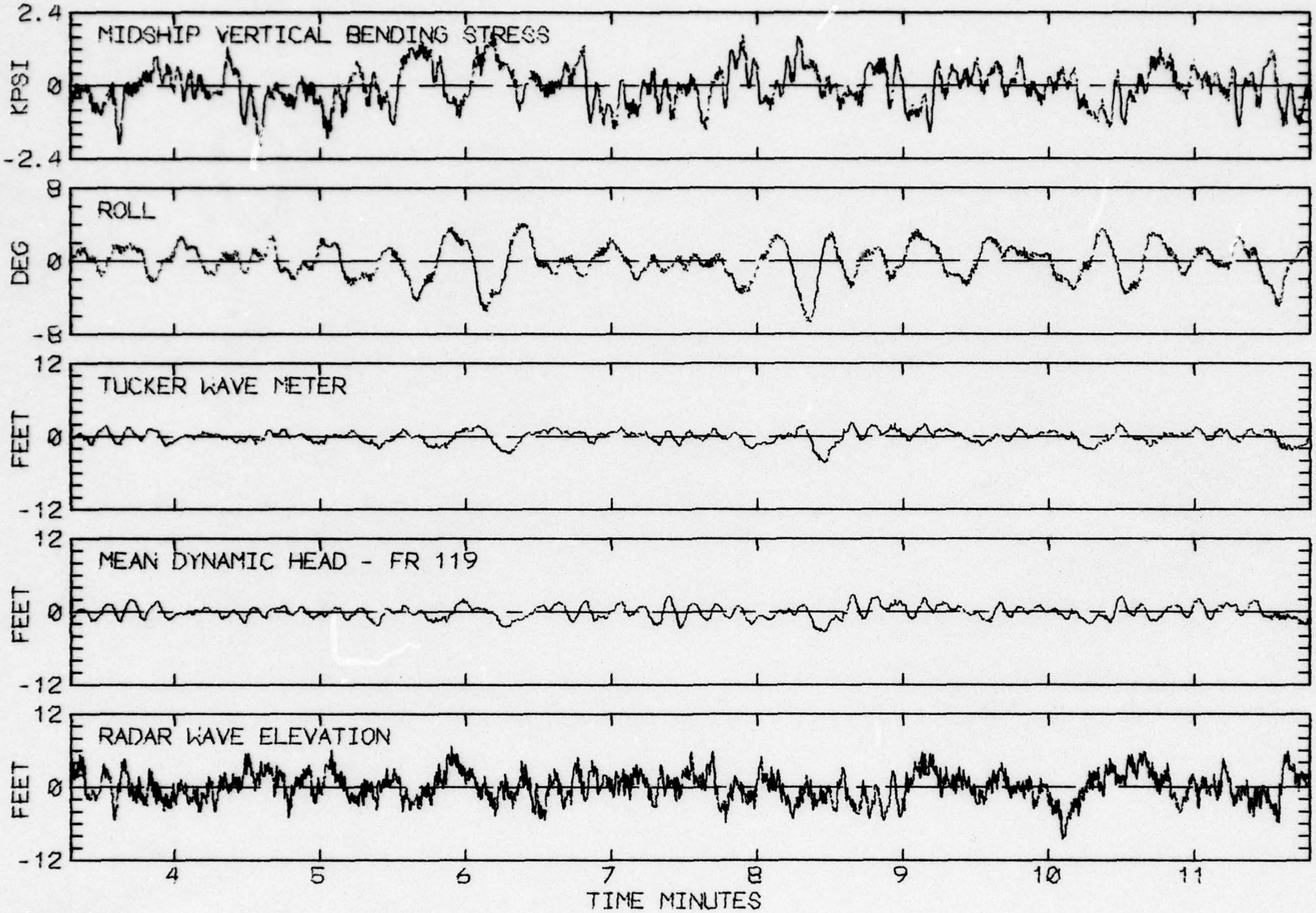
ROLL	7.5 DEG
PITCH	0.53 DEG
DK HSE VERT ACCEL	0.12 G
DK HSE LAT ACCEL	0.18 G
RADAR SLANT RANGE	17.9 FEET
VERTICAL RANGE	12.2 FEET
DISPL AT RADAR	6.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	164	135	310
MAXIMUM HEIGHT	6.1	5.2	11.6
10TH HIGHEST HTS	3.3	3.7	7.8
3RD HIGHEST HTS	2.2	2.9	6.0
4.0 RMS(SPECTRA)	3.7	3.9	10.4



RUN 1029 -- VOYAGE 34E -- TAPE 157 -- INDEX 8 -- INTERVAL 29



RUN 1029 -- VOYAGE 34E -- TAPE 157 -- INDEX 8 -- INTERVAL 29

LOG BOOK DATA	
DATE AND TIME	01-30-74 2400
POSITION	40-31 N 59-02 W
COURSE AND SPEED	090 , 32.1 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	45 STBD
SWELL HEIGHT	5 FEET
" REL DIR	180

---- VISUAL WEATHER / COMMENTS ----

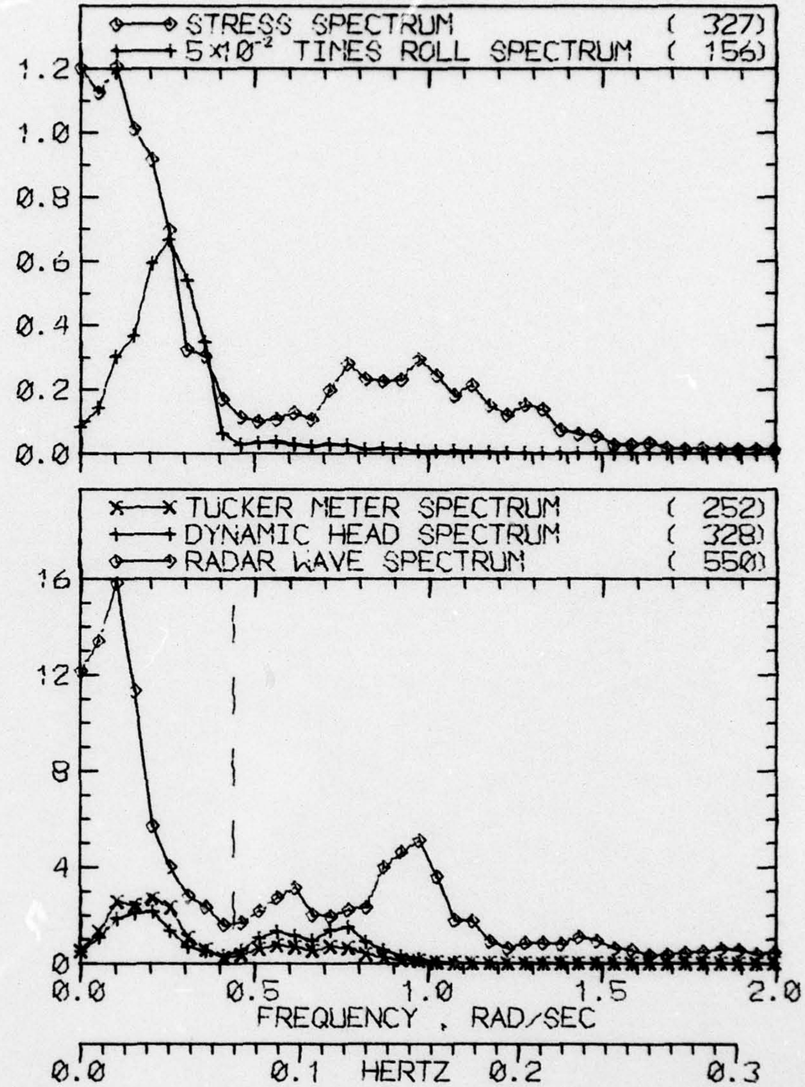
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.2 KPSI
4.0 X RMS	2.9 KPSI

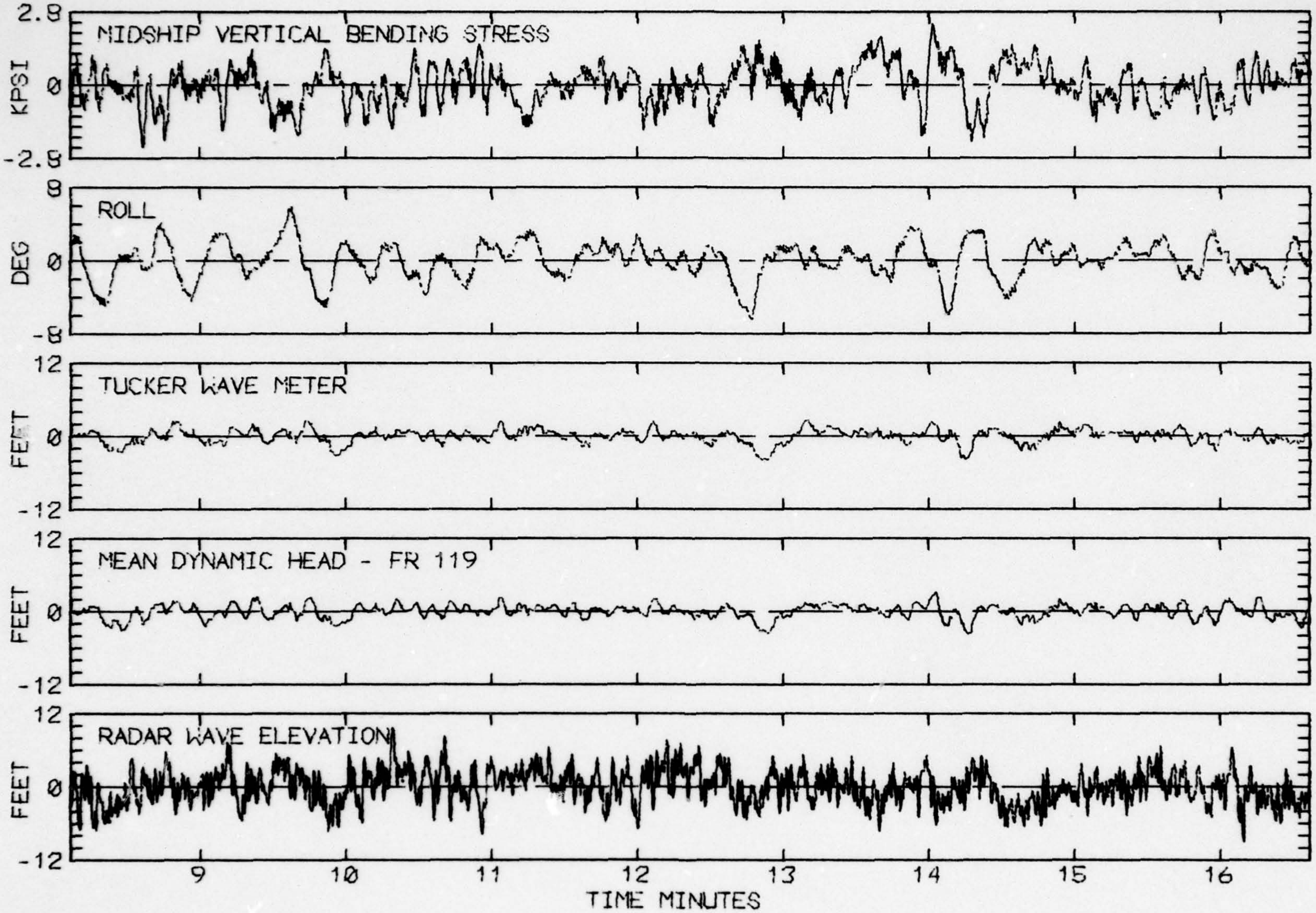
SUMMARY OF MOTIONS (4.0 X RMS)		
ROLL	7.4	DEG
PITCH	0.66	DEG
DK HSE VERT ACCEL	0.15	G
DK HSE LAT ACCEL	0.16	G
RADAR SLANT RANGE	18.1	FEET
VERTICAL RANGE	13.5	FEET
DISPL AT RADAR	7.1	FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	185	138	354
MAXIMUM HEIGHT	5.1	6.0	14.3
10TH HIGHEST HTS	3.4	4.2	10.0
3RD HIGHEST HTS	2.5	3.3	8.0
4.0 RMS(SPECTRA)	4.0	4.2	11.2



RUN 1033 -- VOYAGE 34E -- TAPE 157 -- INDEX 9 -- INTERVAL 33



RUN 1033 -- VOYAGE 34E -- TAPE 157 -- INDEX 9 -- INTERVAL 33

LOG BOOK DATA	
DATE AND TIME	01-31-74 0400
POSITION	40-31 N 59-02 W
COURSE AND SPEED	090 , 31.9 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	22 STBD
SWELL HEIGHT	5 FEET
" REL DIR	180

---- VISUAL WEATHER / COMMENTS ----

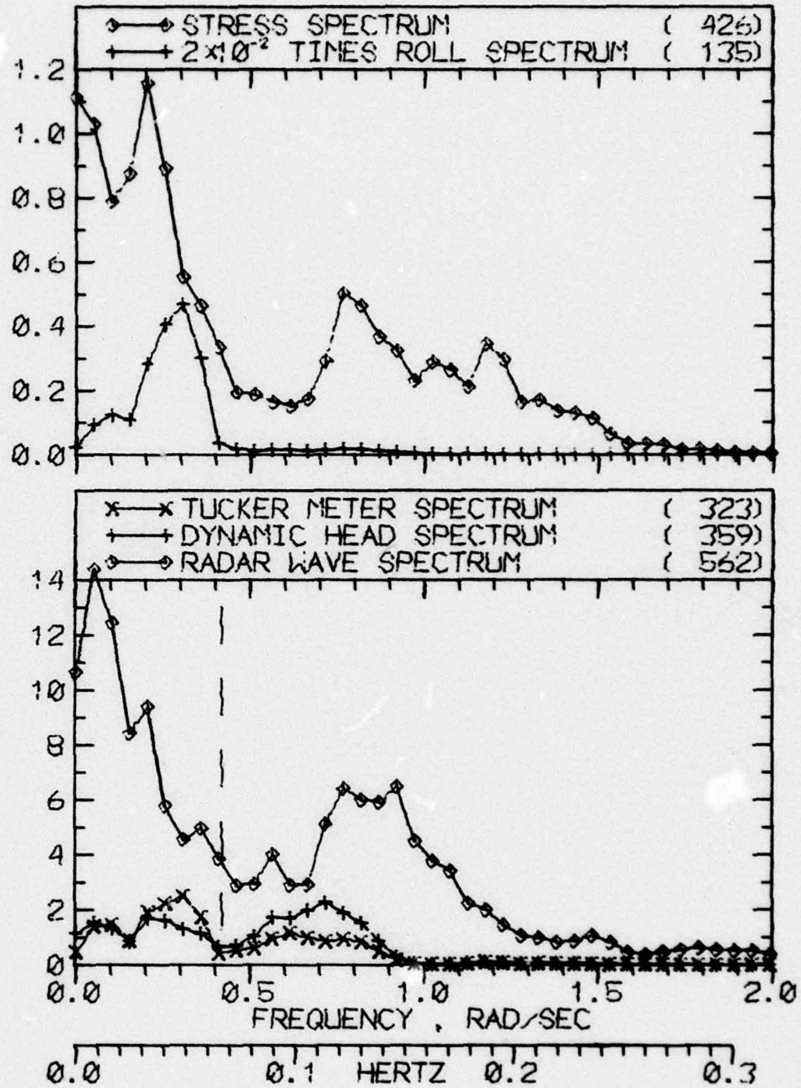
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	3.7 KPSI
4.0 X RMS	3.2 KPSI

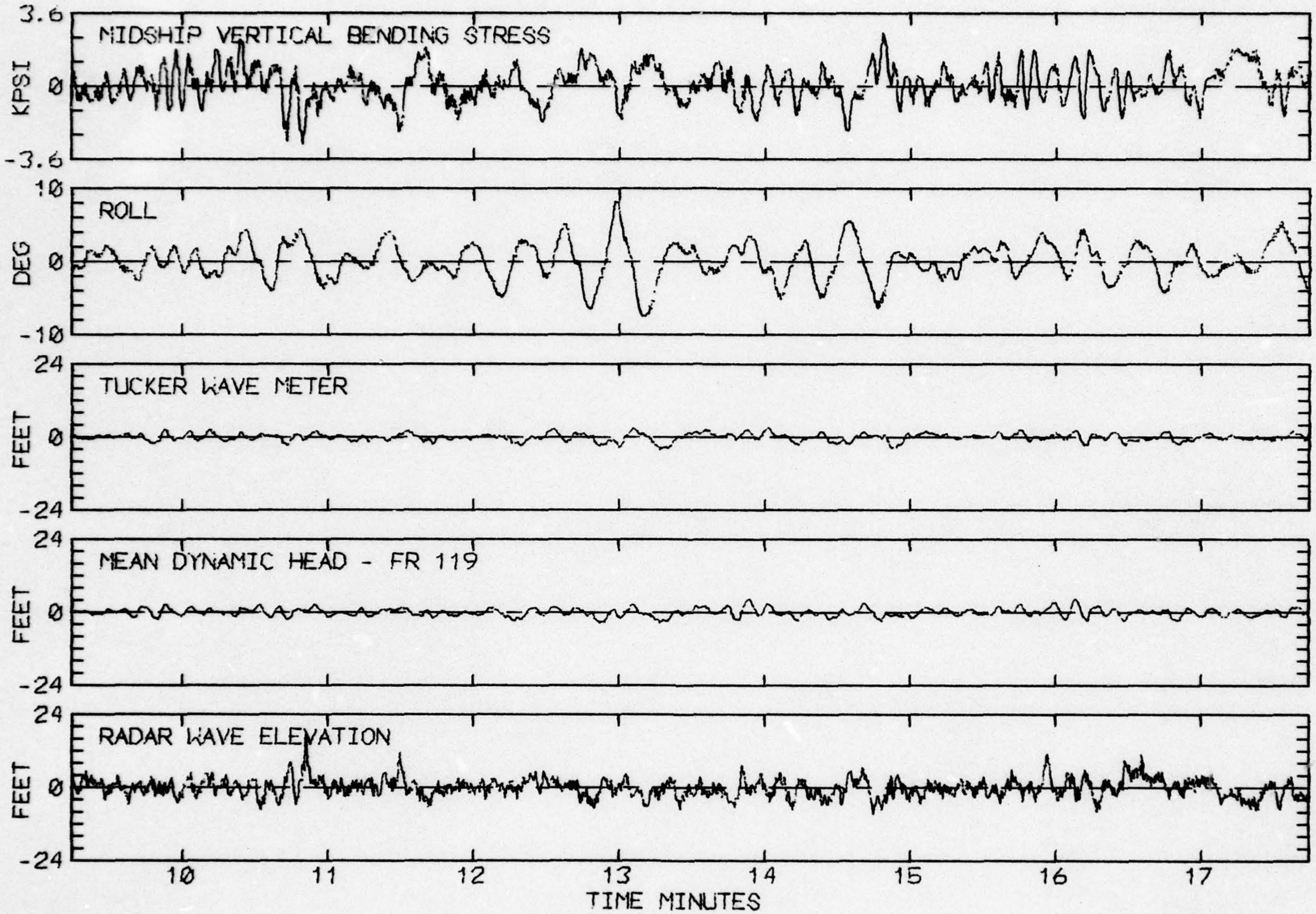
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	9.1 DEG
PITCH	0.83 DEG
DK HSE VERT ACCEL	0.19 G
DK HSE LAT ACCEL	0.20 G
RADAR SLANT RANGE	20.6 FEET
VERTICAL RANGE	15.3 FEET
DISPL AT RADAR	9.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	193	156	301
MAXIMUM HEIGHT	5.1	7.0	17.8
10TH HIGHEST HTS	3.9	4.5	11.1
3RD HIGHEST HTS	2.8	3.4	8.0
4.0 RMS(SPECTRA)	4.2	4.6	11.6



RUN 1037 -- VOYAGE 34E -- TAPE 157 -- INDEX 10 -- INTERVAL 37



RUN 1037 -- VOYAGE 34E -- TAPE 157 -- INDEX 10 -- INTERVAL 37

LOG BOOK DATA	
DATE AND TIME	01-31-74 0800
POSITION	40-31 N 59-02 W
COURSE AND SPEED	090 . 32.2 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	11 STBD
SWELL HEIGHT	5 FEET
" REL DIR	180

---- VISUAL WEATHER / COMMENTS ----

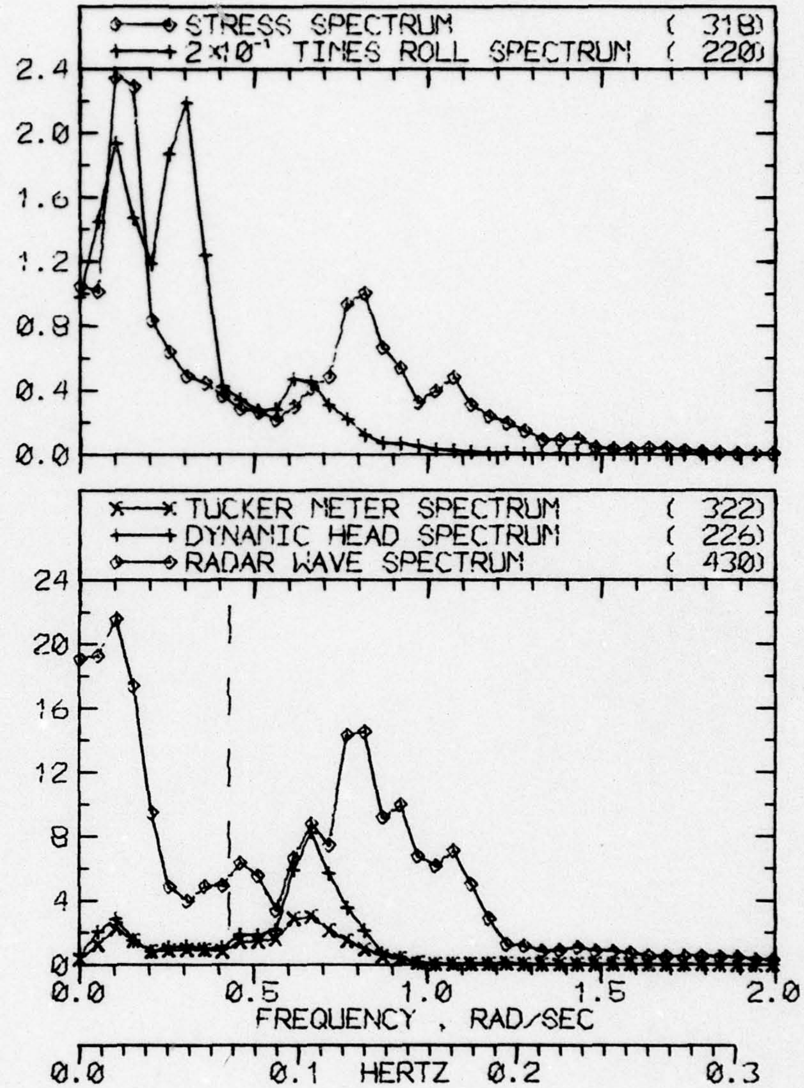
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.5 KPSI
4.0 X RMS	3.7 KPSI

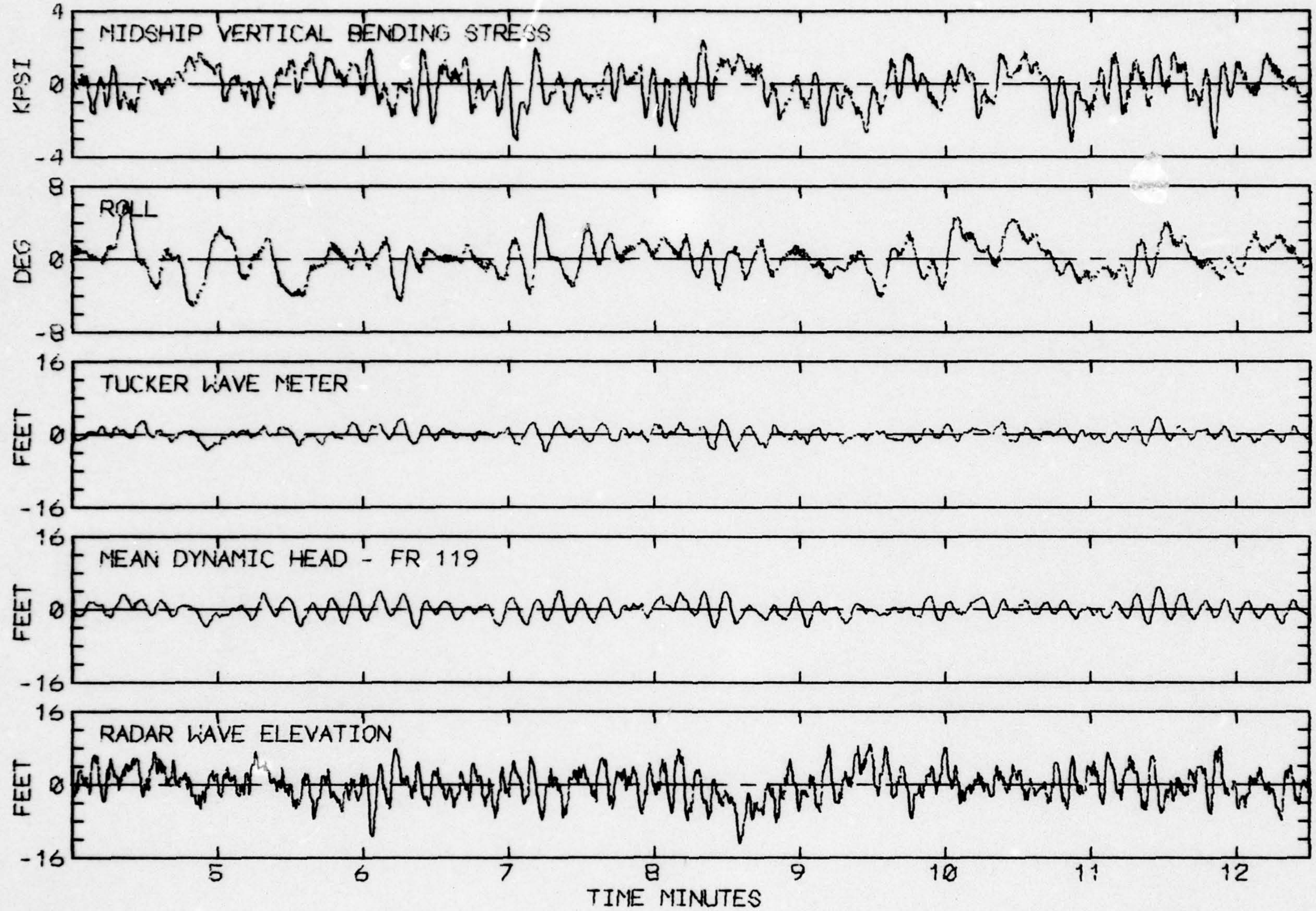
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	7.9 DEG
PITCH	1.03 DEG
DK HSE VERT ACCEL	0.24 G
DK HSE LAT ACCEL	0.18 G
RADAR SLANT RANGE	21.7 FEET
VERTICAL RANGE	18.3 FEET
DISPL AT RADAR	13.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	159	116	189
MAXIMUM HEIGHT	6.8	7.6	15.5
10TH HIGHEST HTS	4.9	6.6	12.7
3RD HIGHEST HTS	3.7	5.5	10.6
4.0 RMS(SPECTRA)	4.7	6.1	13.8



RUN 1041 -- VOYAGE 34E -- TAPE 157 -- INDEX 11 -- INTERVAL 41



RUN 1041 -- VOYAGE 34E -- TAPE 157 -- INDEX 11 -- INTERVAL 41

LOG BOOK DATA	
DATE AND TIME	01-31-74 1200
POSITION	40-59 N 43-08 W
COURSE AND SPEED	090 . 32.6 KNOTS
SEA STATE	2
WAVE HEIGHT	3 FEET
" REL DIR	11 STBD
SWELL HEIGHT	8 FEET
" REL DIR	180

---- VISUAL WEATHER / COMMENTS ----

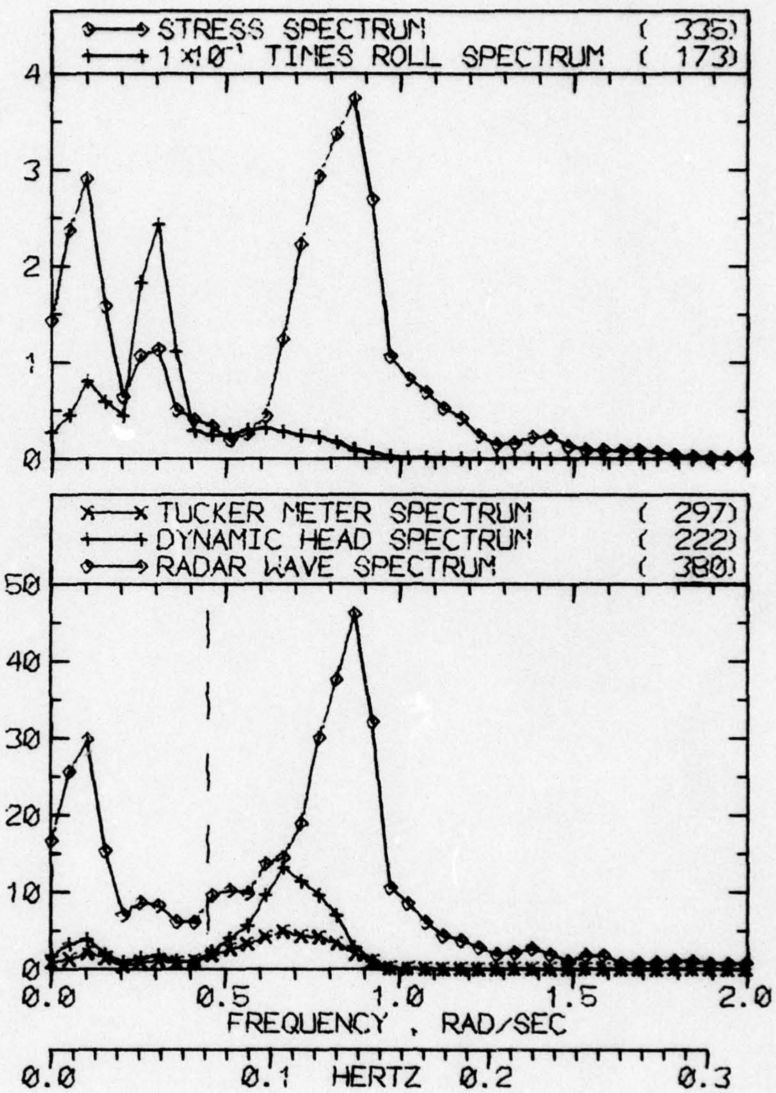
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	7.4 KPSI
4.0 X RMS	5.3 KPSI

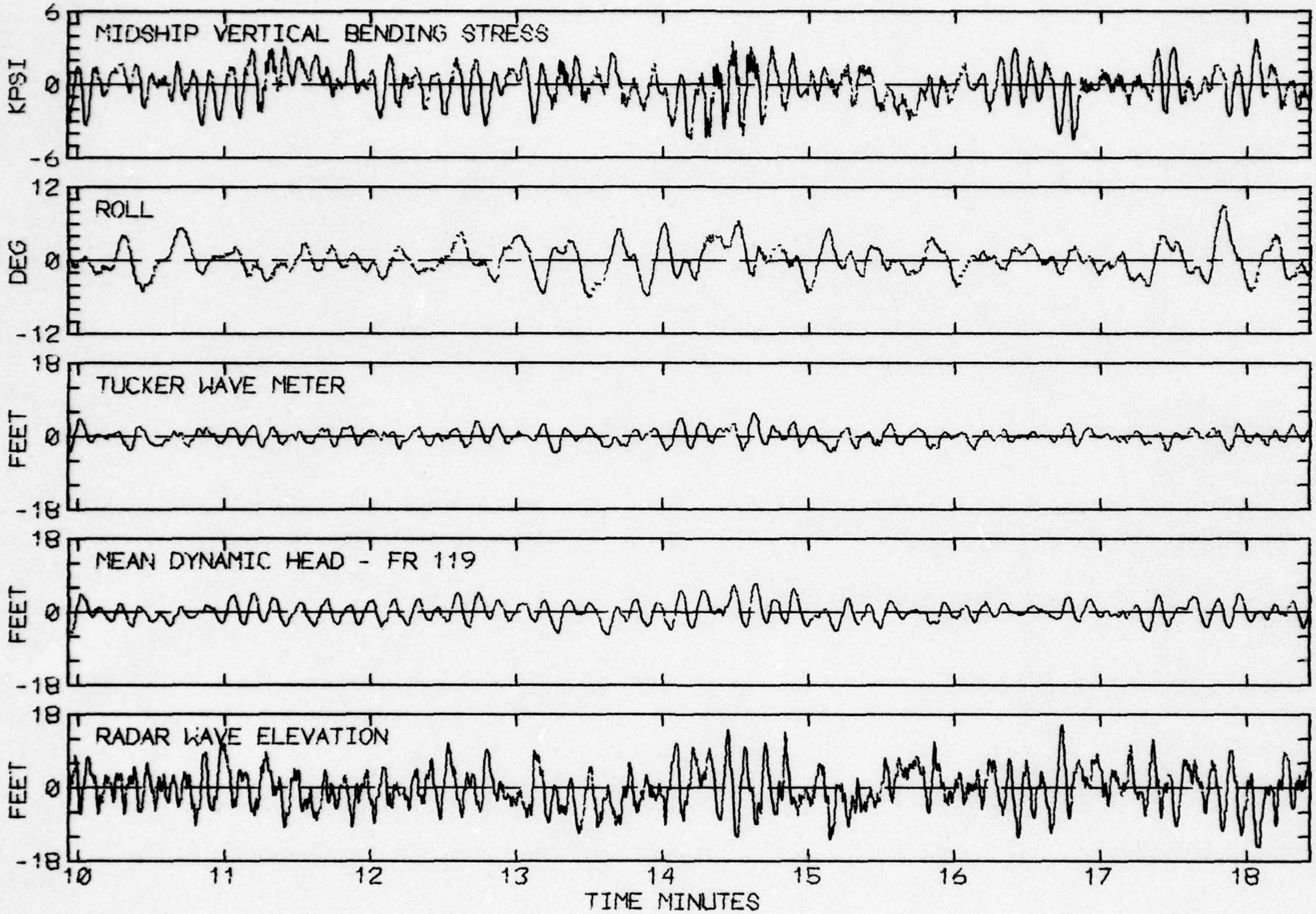
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	9.2 DEG
PITCH	1.64 DEG
DK HSE VERT ACCEL	0.39 G
DK HSE LAT ACCEL	0.22 G
RADAR SLANT RANGE	30.2 FEET
VERTICAL RANGE	28.3 FEET
DISPL AT RADAR	21.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	160	111	188
MAXIMUM HEIGHT	7.8	10.1	27.5
10TH HIGHEST HTS	6.1	8.8	20.4
3RD HIGHEST HTS	5.0	7.4	15.8
4.0 RMS(SPECTRA)	6.0	8.3	18.4



RUN 1045 -- VOYAGE 34E -- TAPE 157 -- INDEX 12 -- INTERVAL 45



RUN 1045 -- VOYAGE 34E -- TAPE 157 -- INDEX 12 -- INTERVAL 45

LOG BOOK DATA	
DATE AND TIME	01-31-74 1600
POSITION	40-59 N 43-08 W
COURSE AND SPEED	073 , 32.3 KNOTS
SEA STATE	2
WAVE HEIGHT	2 FEET
" REL DIR	95 PORT
SWELL HEIGHT	8 FEET
" REL DIR	152 STBD

---- VISUAL WEATHER / COMMENTS ----

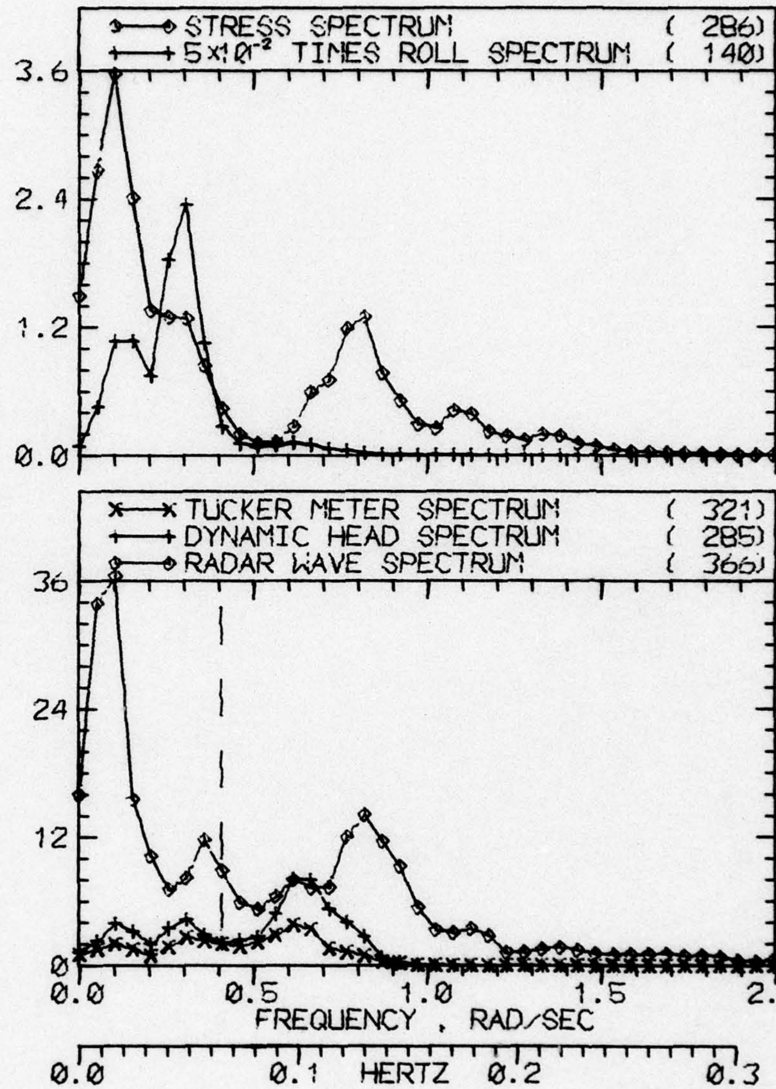
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.8 KPSI
4.0 X RMS	4.4 KPSI

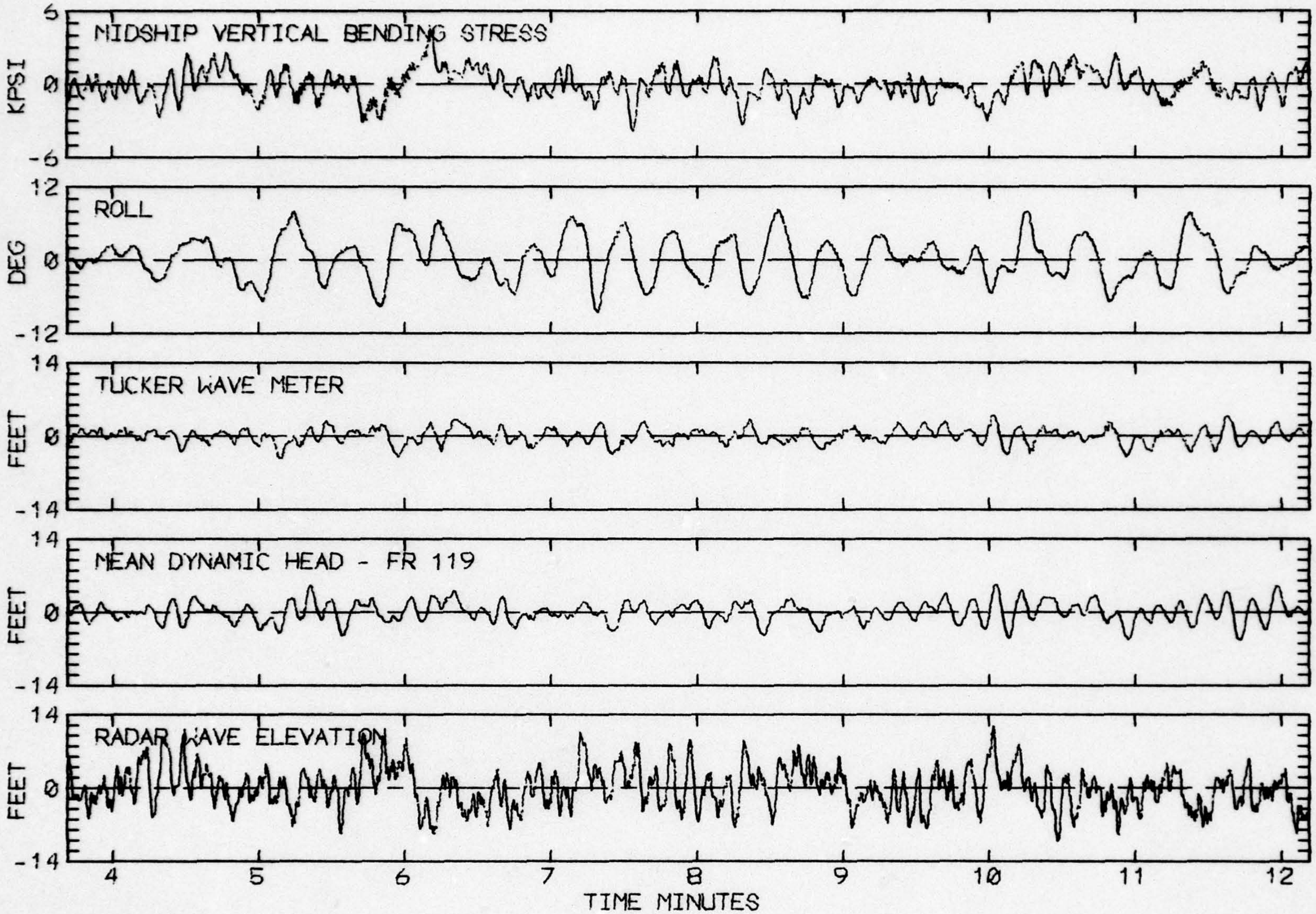
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	12.6 DEG
PITCH	1.09 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.27 G
RADAR SLANT RANGE	25.0 FEET
VERTICAL RANGE	19.8 FEET
DISPL AT RADAR	14.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	135	105	193
MAXIMUM HEIGHT	7.4	10.5	18.2
10TH HIGHEST HTS	5.8	8.0	13.8
3RD HIGHEST HTS	4.4	6.4	11.1
4.0 RMS(SPECTRA)	5.4	7.3	15.1



RUN 1049 -- VOYAGE 34E -- TAPE 157 -- INDEX 13 -- INTERVAL 49



RUN 1049 -- VOYAGE 34E -- TAPE 157 -- INDEX 13 -- INTERVAL 49

LOG BOOK DATA	
DATE AND TIME	01-31-74 2000
POSITION	40-59 N 43-08 W
COURSE AND SPEED	073 , 32.1 KNOTS
SEA STATE	2
WAVE HEIGHT	2 FEET
" REL DIR	50 PORT
SWELL HEIGHT	8 FEET
" REL DIR	152 STBD

---- VISUAL WEATHER / COMMENTS ----

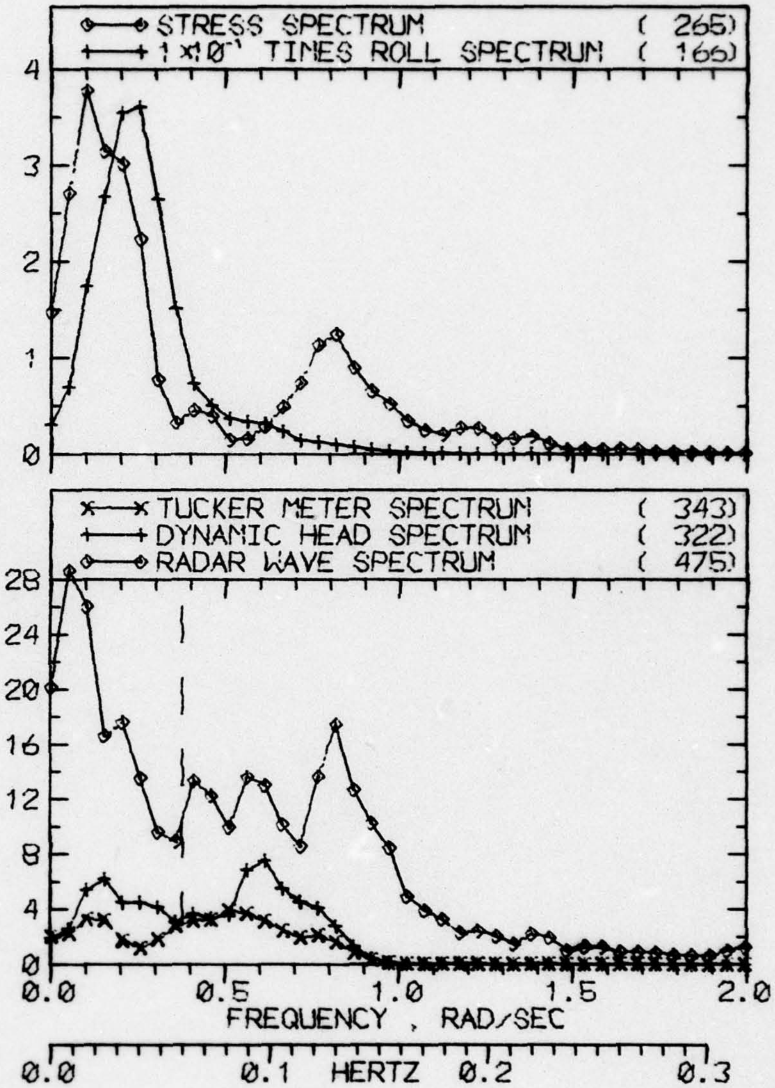
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	7.7 KPSI
4.0 X RMS	4.7 KPSI

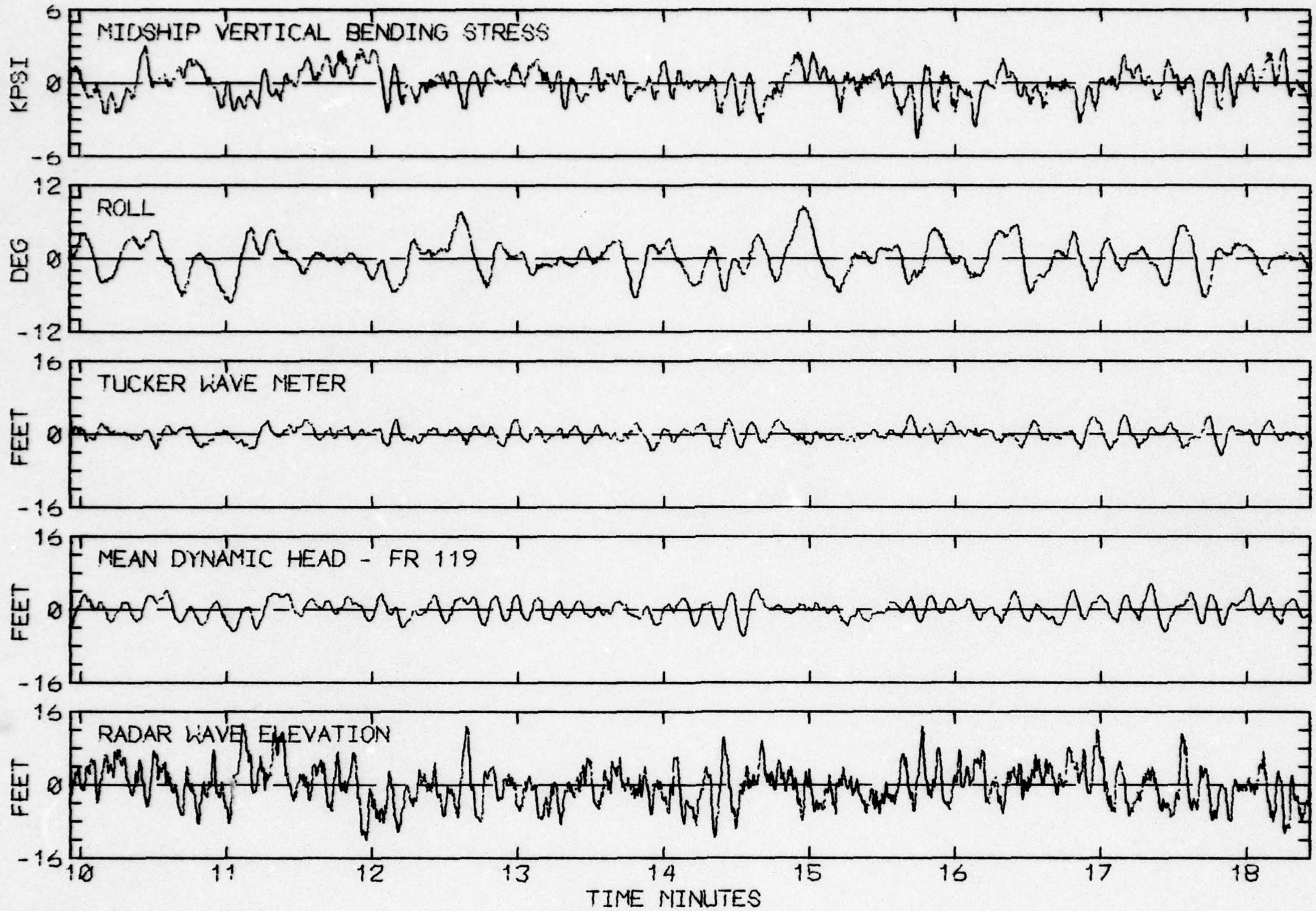
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	12.7 DEG
PITCH	1.13 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.28 G
RADAR SLANT RANGE	25.0 FEET
VERTICAL RANGE	20.7 FEET
DISPL AT RADAR	15.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	/DYN. HEAD	/RADAR
P-T SAMPLE SIZE	154	98	193
MAXIMUM HEIGHT	8.6	10.5	21.0
10TH HIGHEST HTS	6.1	8.4	16.7
3RD HIGHEST HTS	4.6	6.9	12.5
4.0 RMS(SPECTRA)	6.1	7.9	16.4



RUN 1101 -- VOYAGE 34E -- TAPE 159 -- INDEX 14 -- INTERVAL 1



RUN 1101 -- VOYAGE 34E -- TAPE 159 -- INDEX 14 -- INTERVAL 1

LOG BOOK DATA	
DATE AND TIME	01-31-74 2400
POSITION	40-59 N 43-08 W
COURSE AND SPEED	073 , 32.3 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	95 PORT
SWELL HEIGHT	8 FEET
" REL DIR	152 STBD

---- VISUAL WEATHER / COMMENTS ----

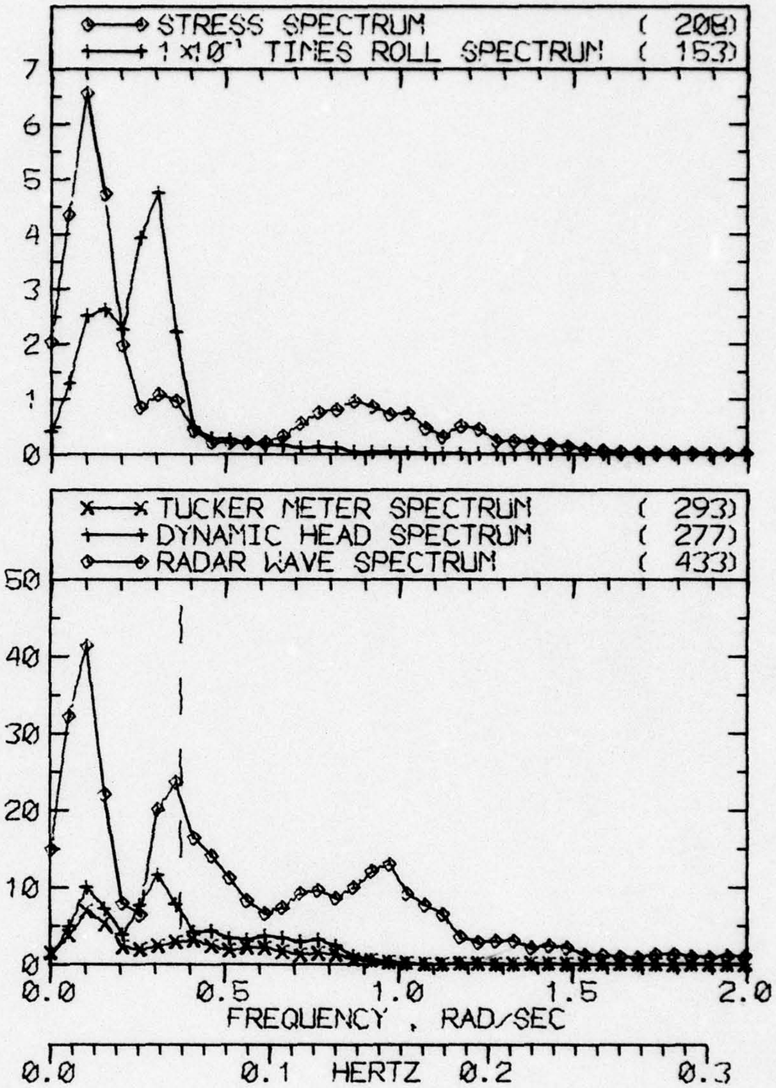
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	5.3 KPSI
4.0 X RMS	5.1 KPSI

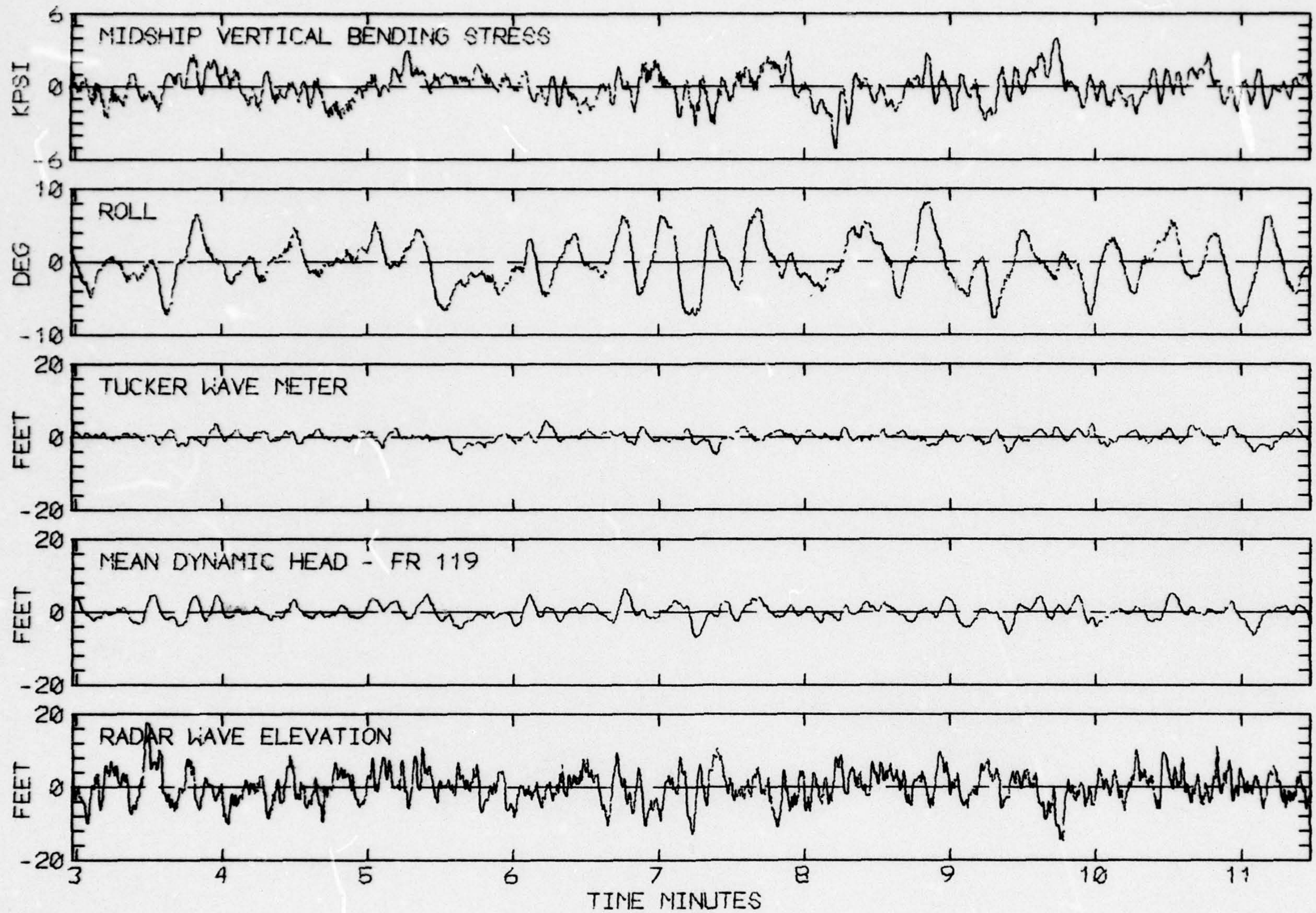
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	13.4 DEG
PITCH	1.11 DEG
DK HSE VERT ACCEL	0.25 G
DK HSE LAT ACCEL	0.30 G
RADAR SLANT RANGE	25.7 FEET
VERTICAL RANGE	20.9 FEET
DISPL AT RADAR	14.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	158	104	196
MAXIMUM HEIGHT	7.9	11.6	23.6
10TH HIGHEST HTS	5.8	8.9	16.7
3RD HIGHEST HTS	4.0	6.9	12.9
4.0 RMS(SPECTRA)	6.2	8.5	17.3



RUN 1105 -- VOYAGE 34E -- TAPE 159 -- INDEX 15 -- INTERVAL 5



RUN 1105 -- VOYAGE 34E -- TAPE 159 -- INDEX 15 -- INTERVAL 5

LOG BOOK DATA

DATE AND TIME	02-01-74 0400
POSITION	40-59 N 43-08 W
COURSE AND SPEED	073 , 31.8 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	95 PORT
SWELL HEIGHT	8 FEET
" REL DIR	107 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

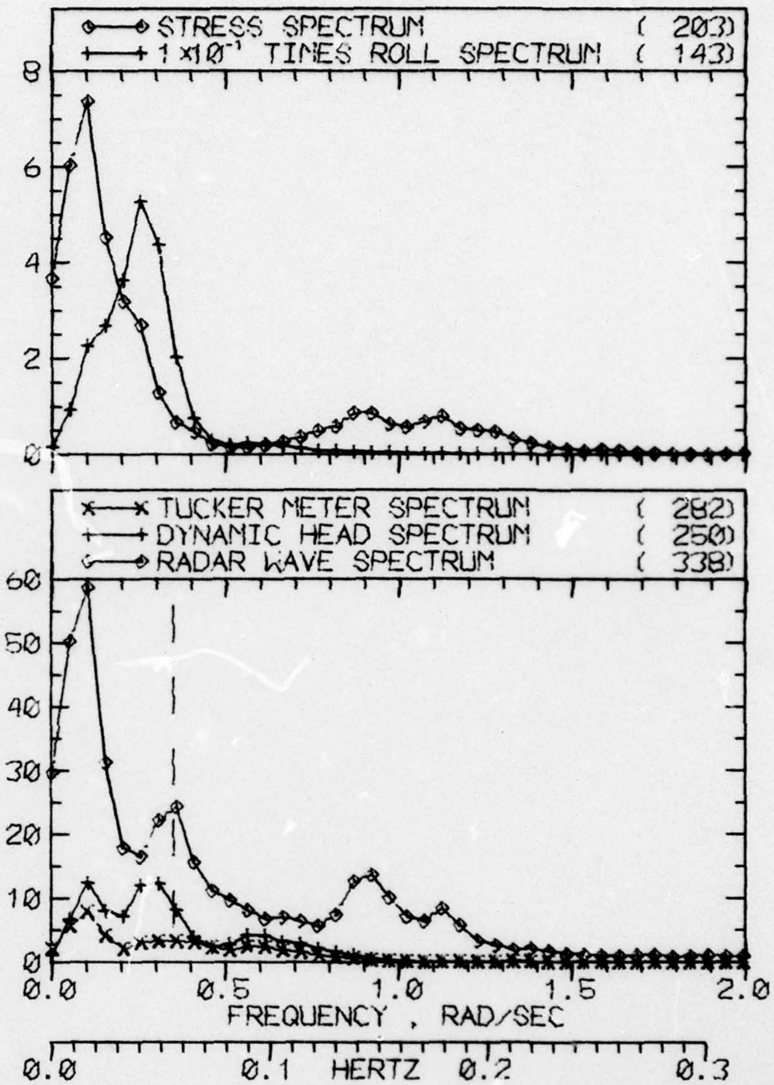
MAXIMUM PK-TR	6.4 KPSI
4.0 X RMS	5.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

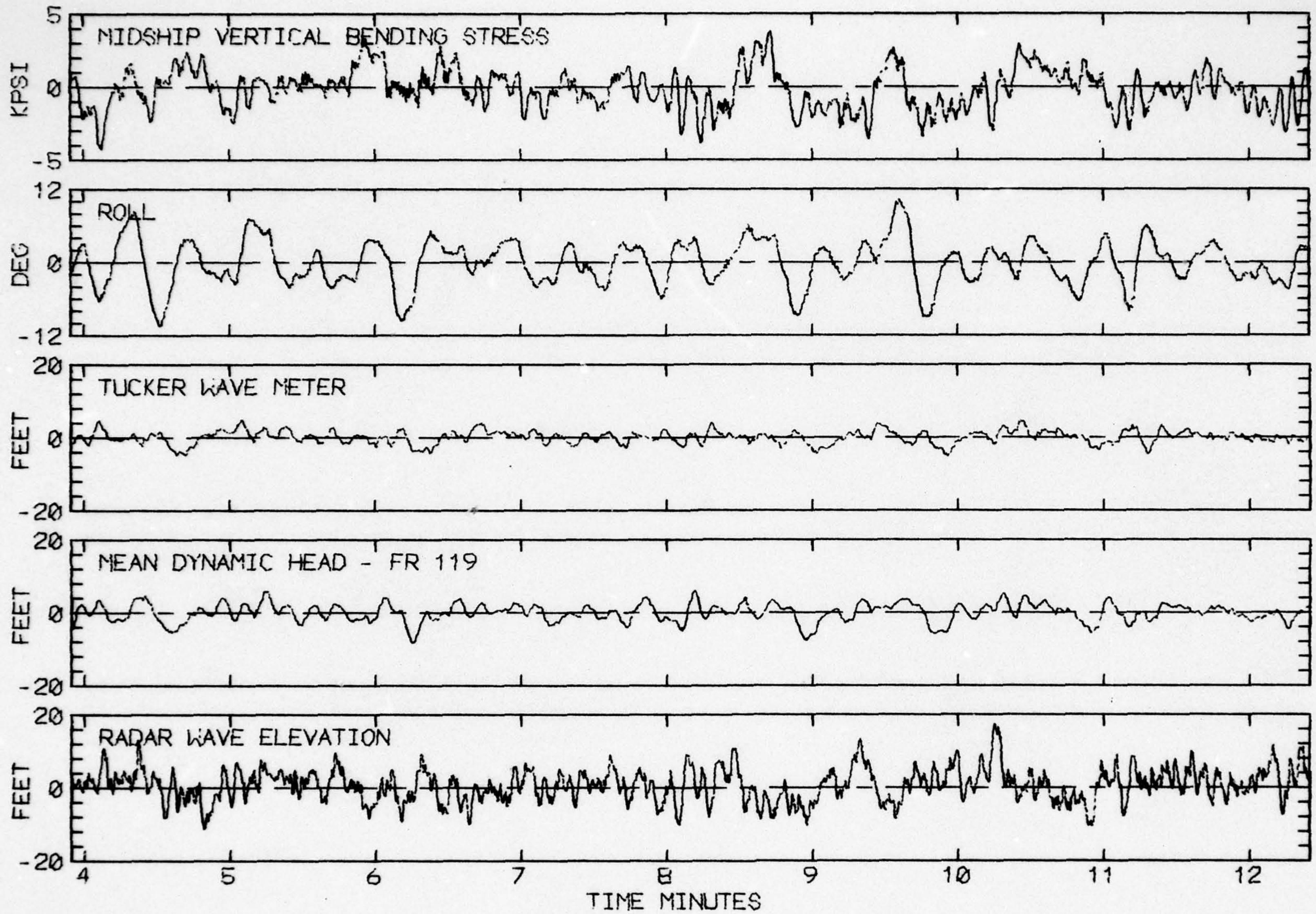
ROLL	13.9 DEG
PITCH	1.04 DEG
DK HSE VERT ACCEL	0.23 G
DK HSE LAT ACCEL	0.30 G
RADAR SLANT RANGE	26.2 FEET
VERTICAL RANGE	21.4 FEET
DISPL AT RADAR	13.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	156	93	177
MAXIMUM HEIGHT	8.4	12.4	22.0
10TH HIGHEST HTS	6.2	9.3	16.9
3RD HIGHEST HTS	4.3	7.2	13.1
4.0 RMS(SPECTRA)	6.5	9.0	18.6



RUN 1109 -- VOYAGE 34E -- TAPE 159 -- INDEX 16 -- INTERVAL 9



RUN 1109 -- VOYAGE 34E -- TAPE 159 -- INDEX 16 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	02-01-74 0800
POSITION	40-59 N 43-08 W
COURSE AND SPEED	073 , 32.3 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	118 PORT
SWELL HEIGHT	8 FEET
" REL DIR	107 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

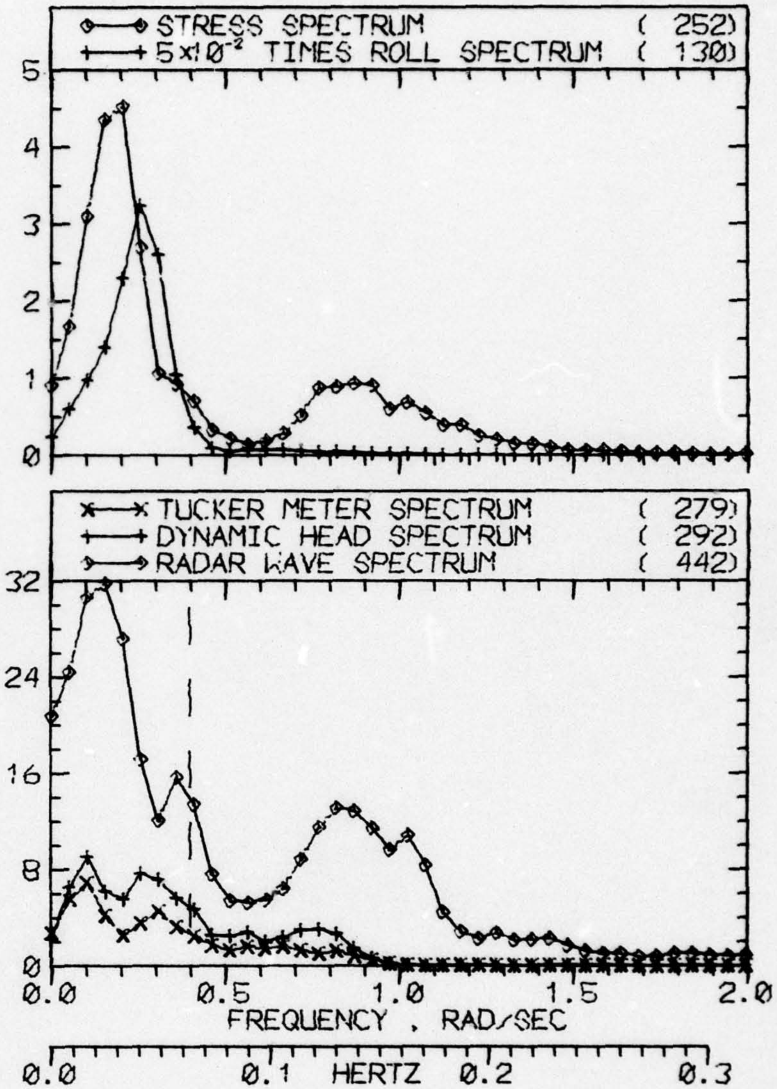
MAXIMUM PK-TR	6.6 KPSI
4.0 X RMS	4.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

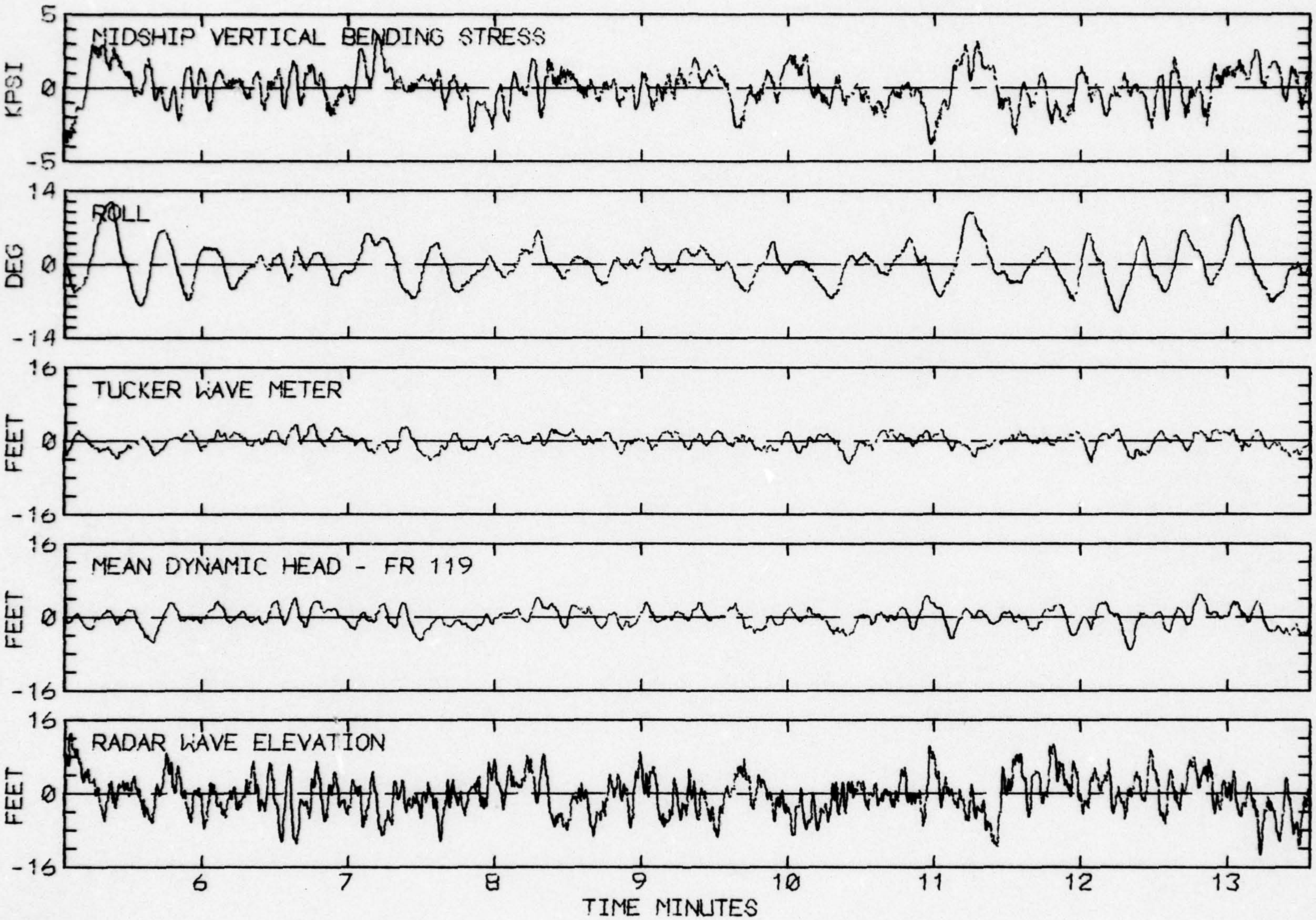
ROLL	14.8 DEG
PITCH	1.13 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.33 G
RADAR SLANT RANGE	26.3 FEET
VERTICAL RANGE	21.8 FEET
DISPL AT RADAR	13.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	134	110	192
MAXIMUM HEIGHT	8.1	10.3	17.3
10TH HIGHEST HTS	5.8	8.0	15.4
3RD HIGHEST HTS	4.3	6.0	12.5
4.0 RMS(SPECTRA)	6.3	8.0	17.0



RUN 1113 -- VOYAGE 34E -- TAPE 159 -- INDEX 17 -- INTERVAL 13



RUN 1113 -- VOYAGE 34E -- TAPE 159 -- INDEX 17 -- INTERVAL 13

LOG BOOK DATA

DATE AND TIME	02-01-74 1200
POSITION	44-27 N 27-18 W
COURSE AND SPEED	072 , 32.3 KNOTS
SEA STATE	5
WAVE HEIGHT	3 FEET
" REL DIR	117 PORT
SWELL HEIGHT	8 FEET
" REL DIR	63 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

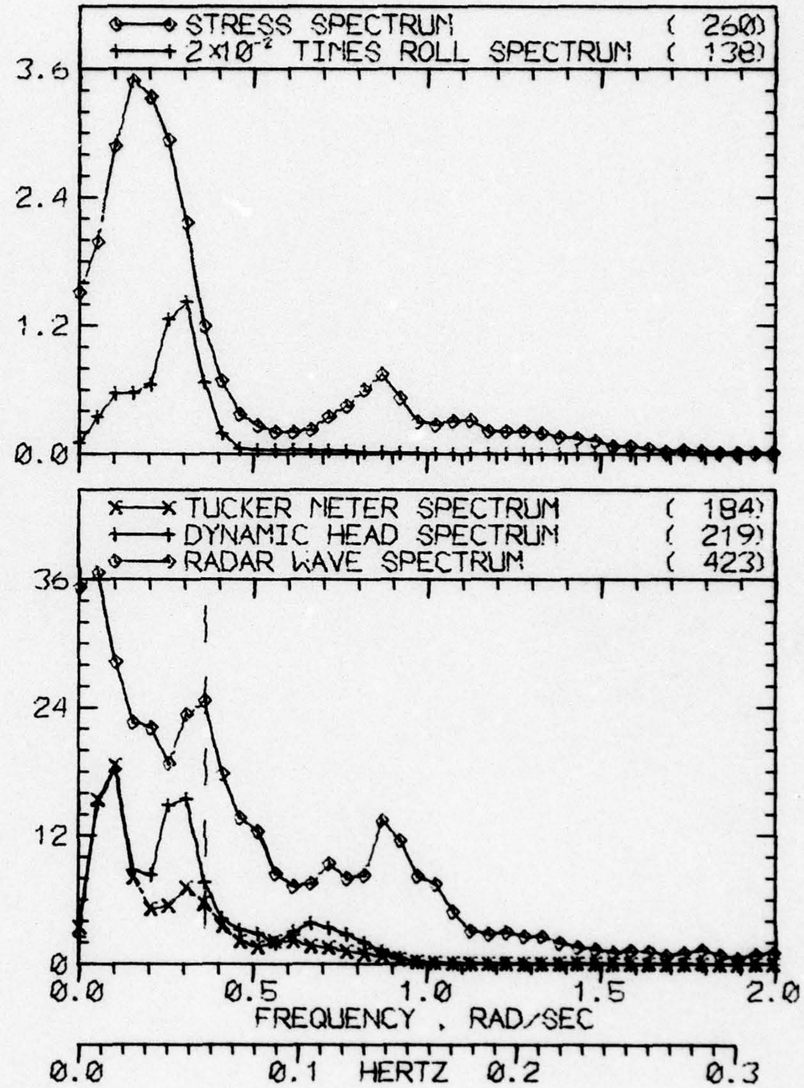
MAXIMUM PK-TR	8.8 KPSI
4.0 X RMS	4.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

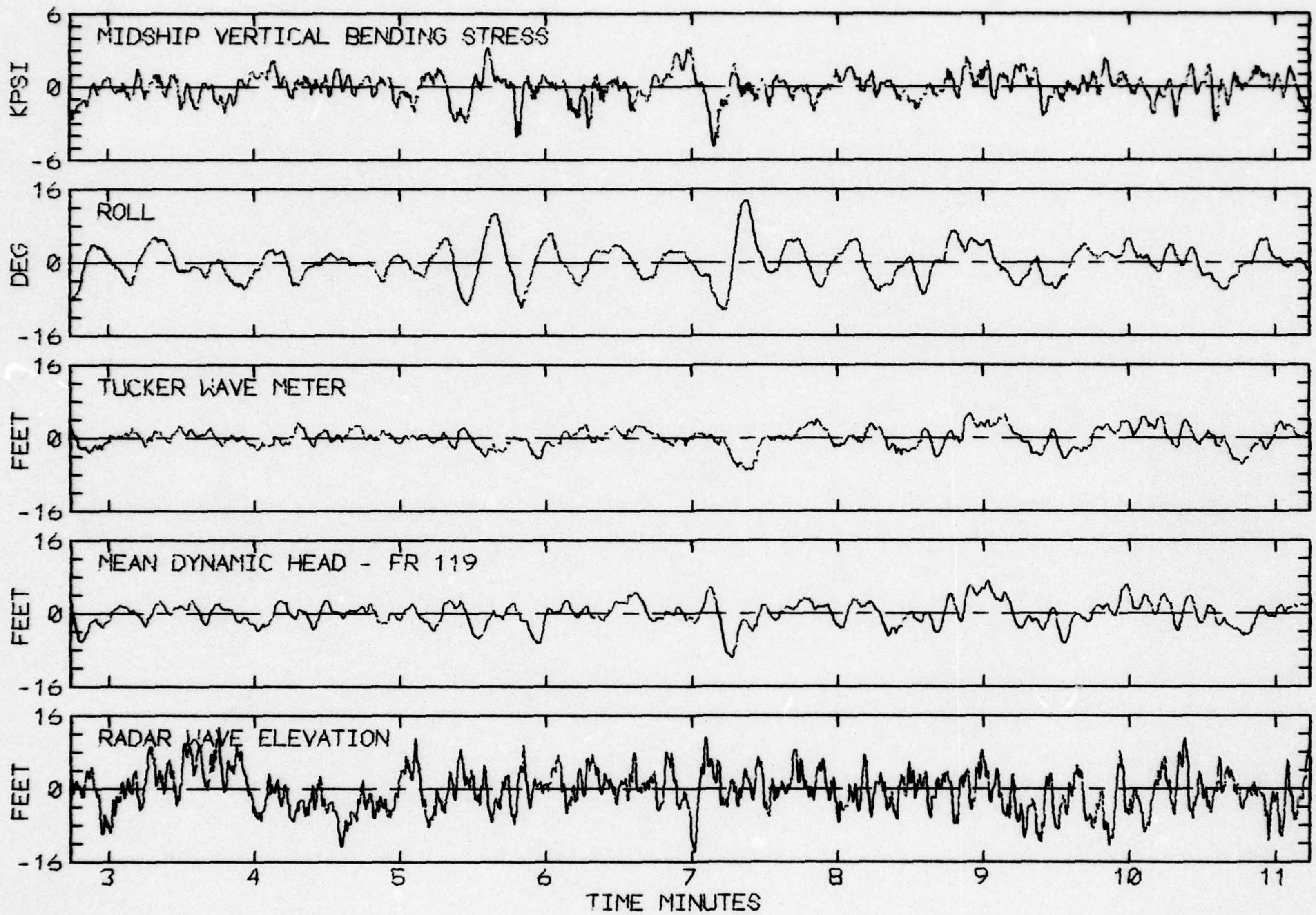
ROLL	15.7	DEG
PITCH	0.98	DEG
DK HSE VERT ACCEL	0.24	G
DK HSE LAT ACCEL	0.35	G
RADAR SLANT RANGE	26.9	FEET
VERTICAL RANGE	20.7	FEET
DISPL AT RADAR	13.2	FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	116	73	173
MAXIMUM HEIGHT	9.3	15.2	22.1
10TH HIGHEST HTS	7.5	10.7	17.6
3RD HIGHEST HTS	5.3	8.2	13.4
4.0 RMS(SPECTRA)	8.5	9.9	17.7



RUN 1117 -- VOYAGE 34E -- TAPE 159 -- INDEX 18 -- INTERVAL 17



RUN 1117 -- VOYAGE 34E -- TAPE 159 -- INDEX 18 -- INTERVAL 17

LOG BOOK DATA	
DATE AND TIME	02-01-74 1600
POSITION	44-27 N 27-18 W
COURSE AND SPEED	072 , 32.4 KNOTS
SEA STATE	7
WAVE HEIGHT	4 FEET
" REL DIR	151 PORT
SWELL HEIGHT	8 FEET
" REL DIR	63 STBD

---- VISUAL WEATHER / COMMENTS ----

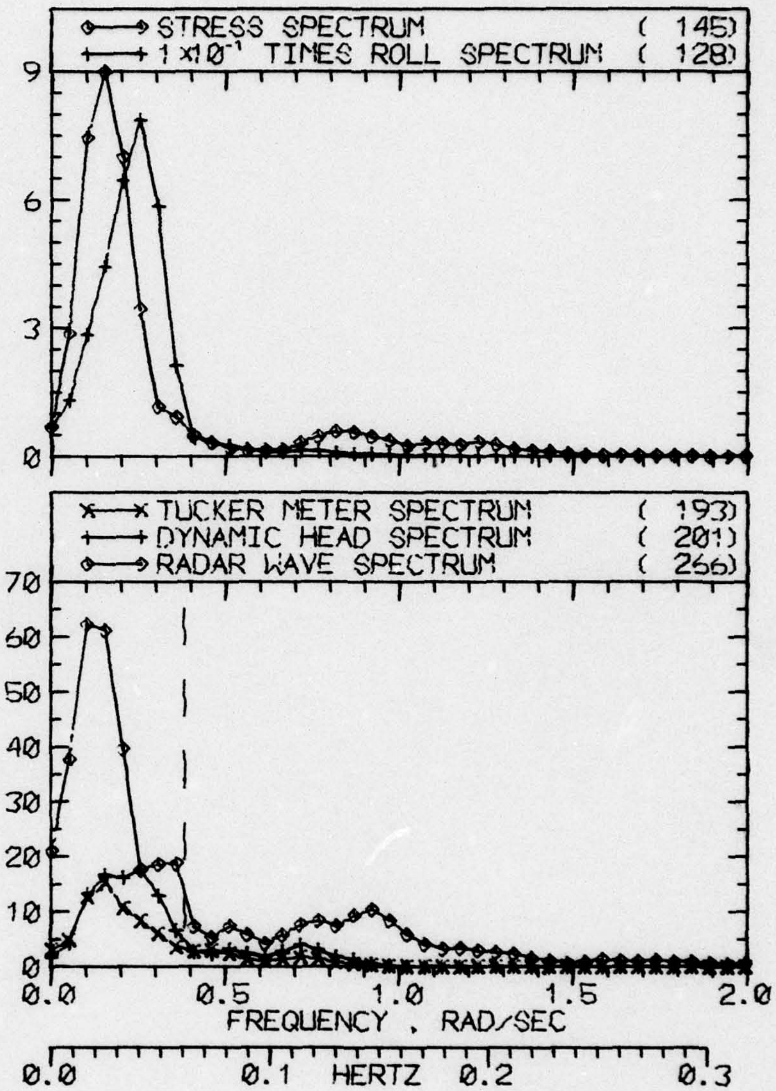
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	7.3 KPSI
4.0 X RMS	5.7 KPSI

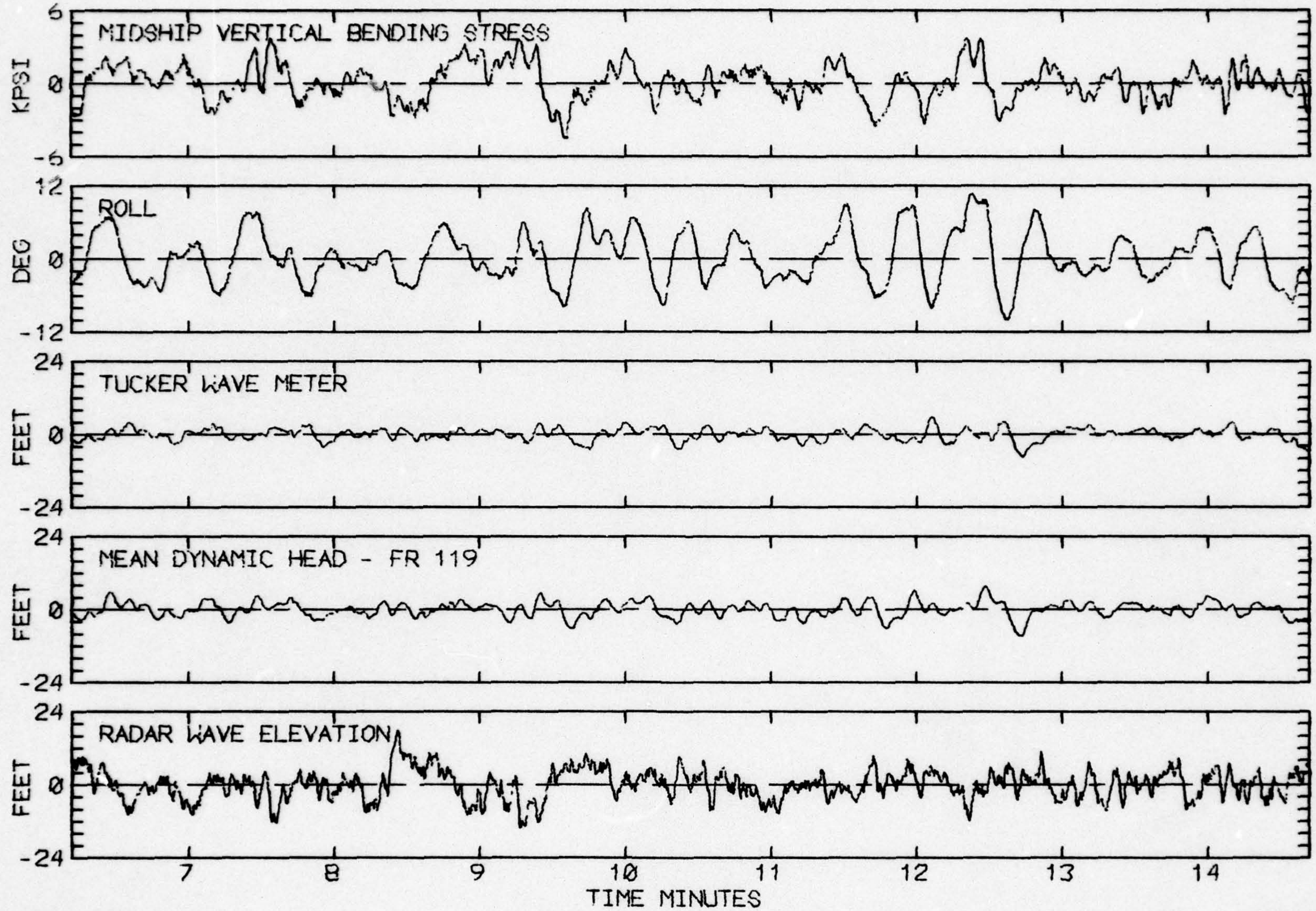
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	16.5 DEG
PITCH	0.95 DEG
DK HSE VERT ACCEL	0.23 G
DK HSE LAT ACCEL	0.34 G
RADAR SLANT RANGE	27.0 FEET
VERTICAL RANGE	22.0 FEET
DISPL AT RADAR	12.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	105	77	178
MAXIMUM HEIGHT	11.6	16.3	21.2
10TH HIGHEST HTS	8.5	11.3	16.1
3RD HIGHEST HTS	5.7	7.9	12.0
4.0 RMS(SPECTRA)	8.2	9.7	18.3



RUN 1122 -- VOYAGE 34E -- TAPE 159 -- INDEX 19 -- INTERVAL 22



RUN 1122 -- VOYAGE 34E -- TAPE 159 -- INDEX 19 -- INTERVAL 22

LOG BOOK DATA	
DATE AND TIME	02-01-74 2000
POSITION	44-27 N 27-18 W
COURSE AND SPEED	072 , 32.3 KNOTS
SEA STATE	7
WAVE HEIGHT	4 FEET
" REL DIR	117 PORT
SWELL HEIGHT	6 FEET
" REL DIR	63 STBD

---- VISUAL WEATHER / COMMENTS ----

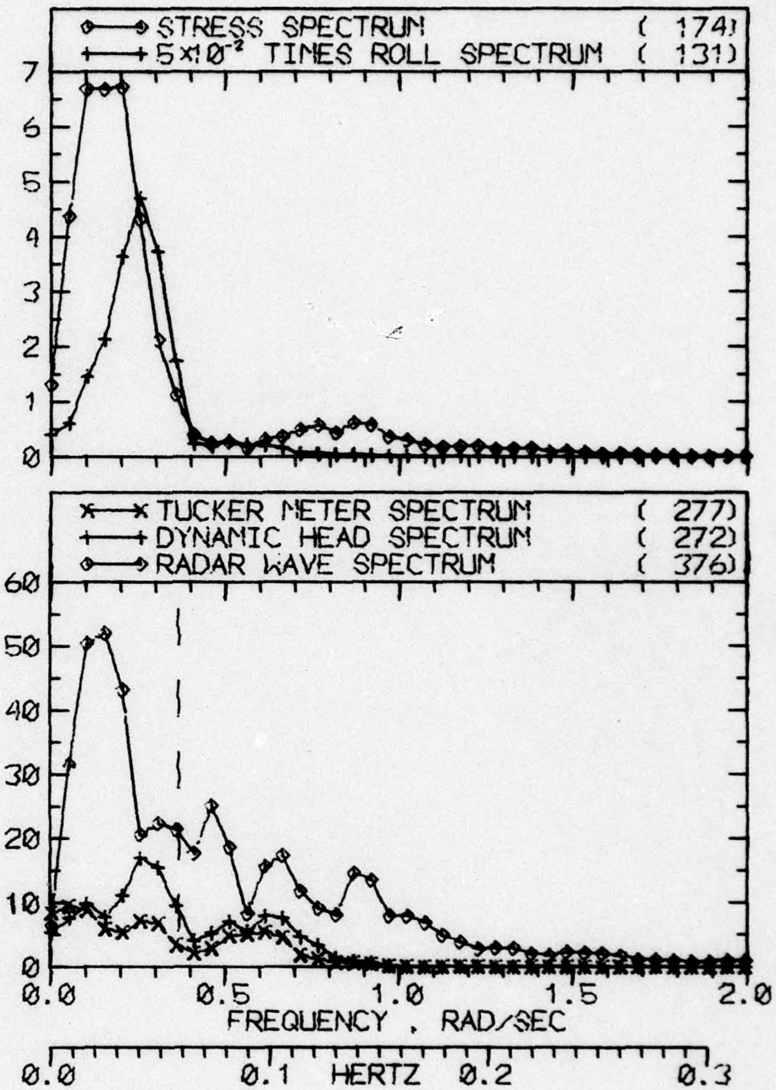
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.4 KPSI
4.0 X RMS	5.7 KPSI

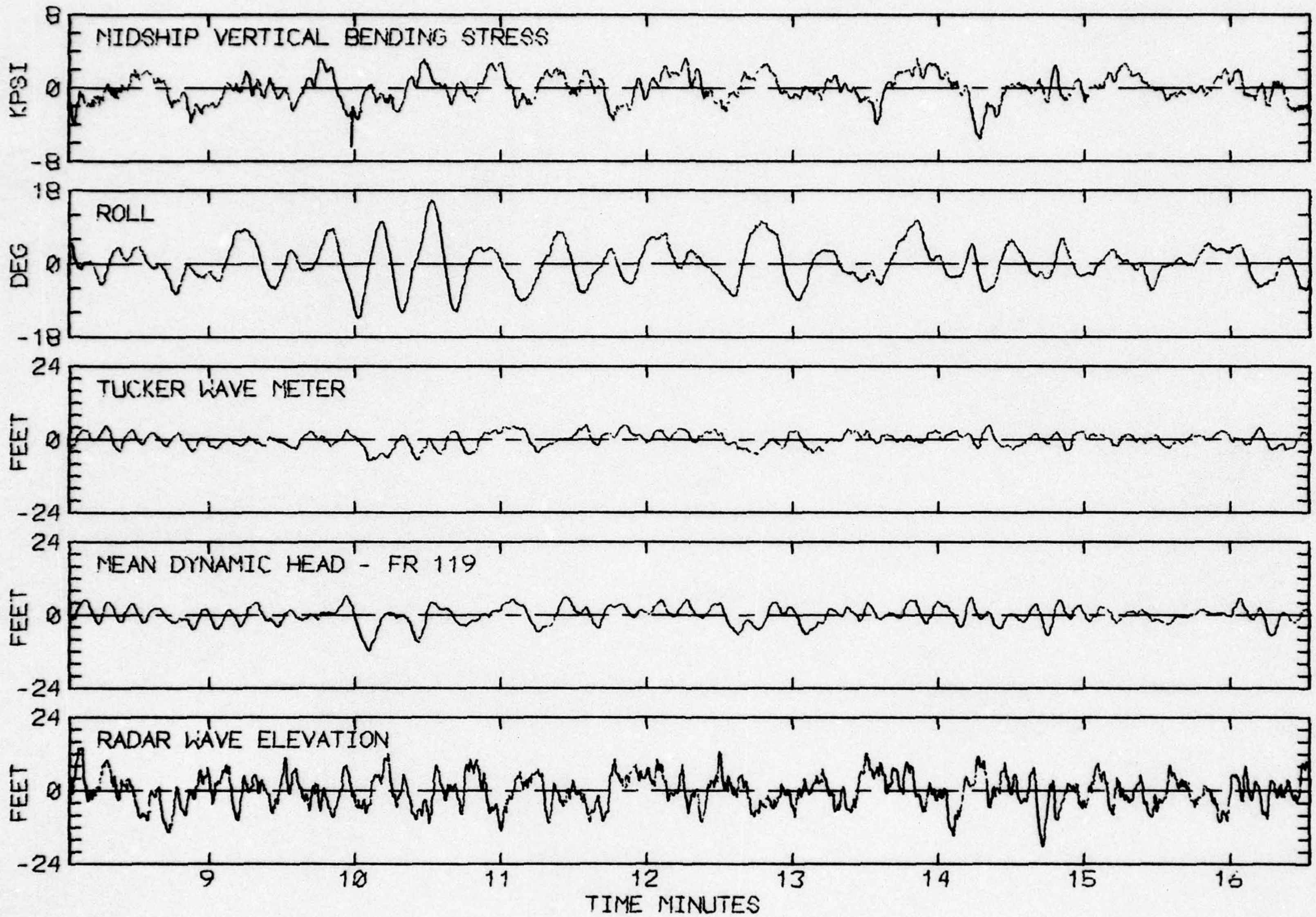
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	18.0 DEG
PITCH	1.04 DEG
DK HSE VERT ACCEL	0.24 G
DK HSE LAT ACCEL	0.39 G
RADAR SLANT RANGE	29.3 FEET
VERTICAL RANGE	22.6 FEET
DISPL AT RADAR	15.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	116	94	176
MAXIMUM HEIGHT	8.8	17.6	25.7
10TH HIGHEST HTS	7.7	11.1	18.1
3RD HIGHEST HTS	6.2	8.6	14.7
4.0 RMS(SPECTRA)	8.2	10.3	19.9



RUN 1125 -- VOYAGE 34E -- TAPE 159 -- INDEX 20 -- INTERVAL 25



RUN 1125 -- VOYAGE 34E -- TAPE 159 -- INDEX 20 -- INTERVAL 25

LOG BOOK DATA	
DATE AND TIME	02-01-74 2400
POSITION	44-27 N 27-18 W
COURSE AND SPEED	072 , 32.6 KNOTS
SEA STATE	7
WAVE HEIGHT	4 FEET
" REL DIR	175 STBD
SWELL HEIGHT	6 FEET
" REL DIR	63 STBD

---- VISUAL WEATHER / COMMENTS ----

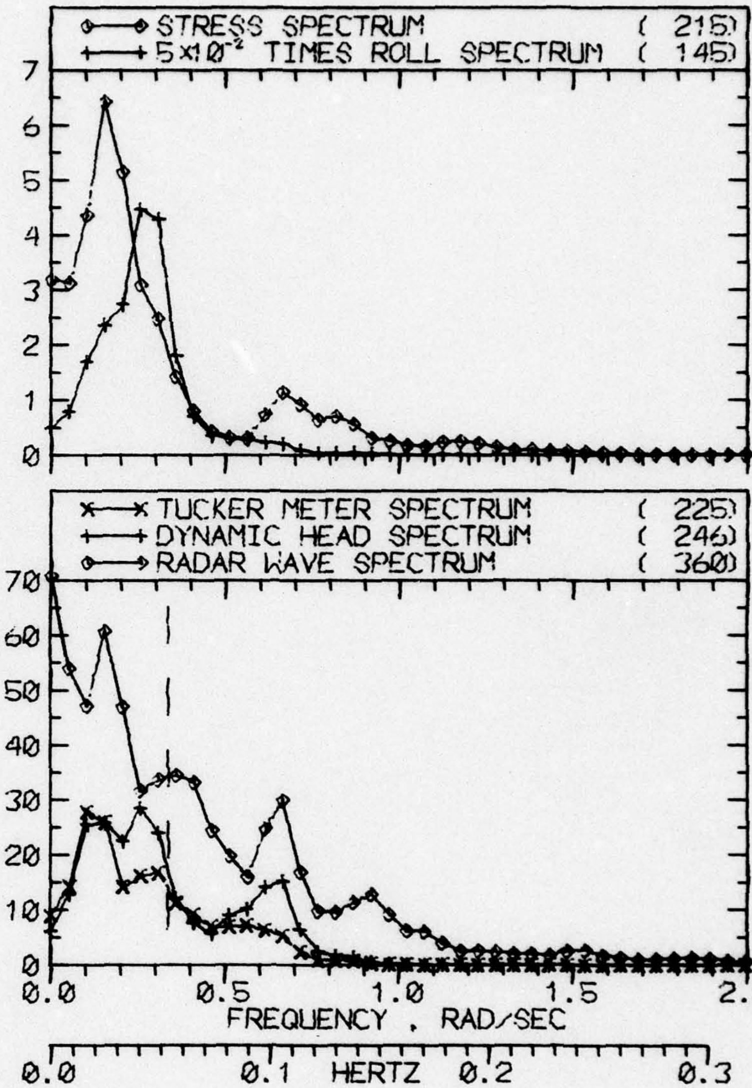
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.9 KPSI
4.0 X RMS	5.5 KPSI

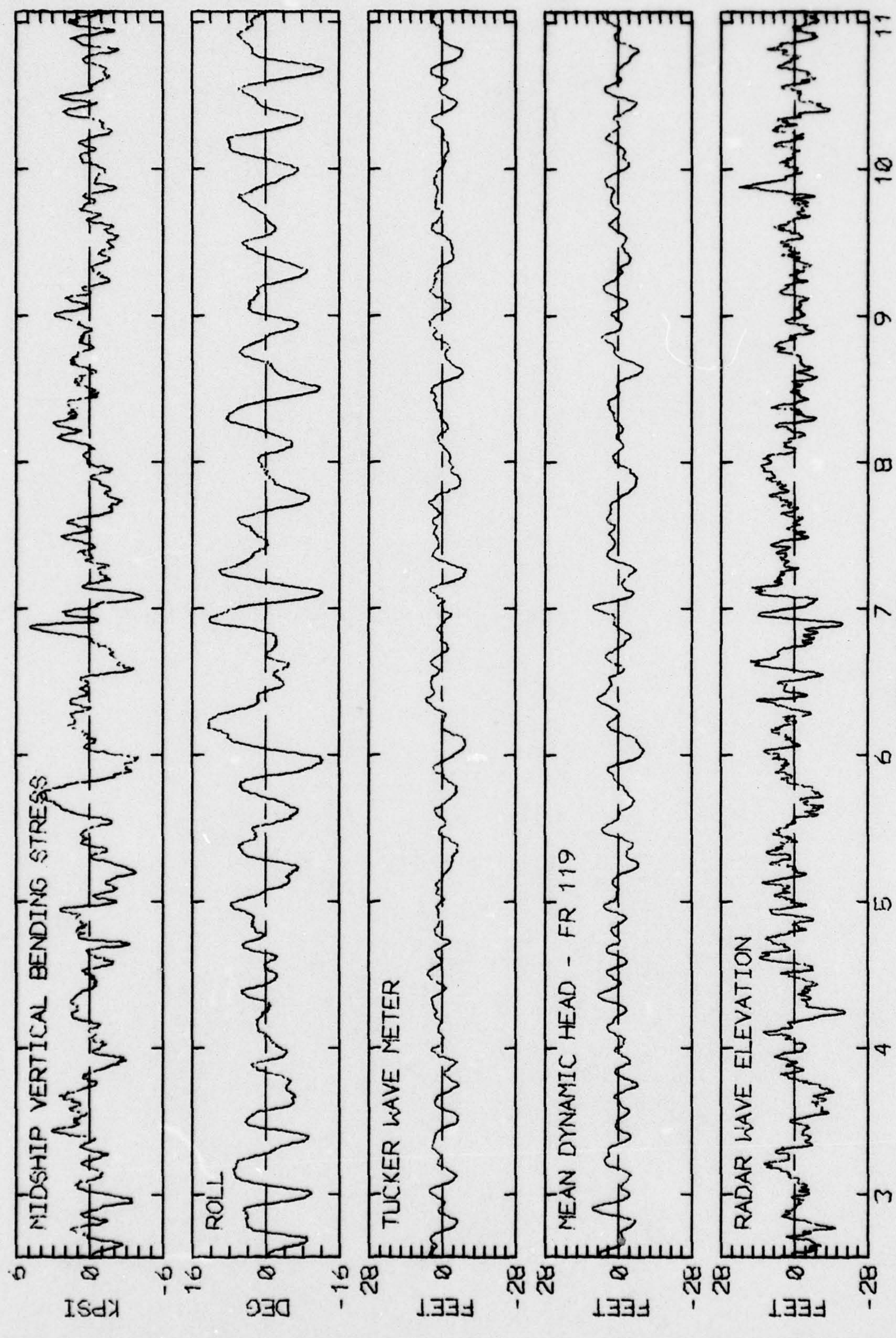
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	18.4 DEG
PITCH	1.04 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.41 G
RADAR SLANT RANGE	33.2 FEET
VERTICAL RANGE	24.9 FEET
DISPL AT RADAR	18.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	78	79	140
MAXIMUM HEIGHT	13.5	16.0	35.1
10TH HIGHEST HTS	12.3	13.9	22.6
3RD HIGHEST HTS	9.8	11.4	17.1
4.0 RMS(SPECTRA)	12.1	13.7	22.6



RUN 1129 -- VOYAGE 34E -- TAPE 159 -- INDEX 21 -- INTERVAL 29



RUN 1129 -- VOYAGE 34E -- TAPE 159 -- INDEX 21 -- INTERVAL 29

LOG BOOK DATA	
DATE AND TIME	02-02-74 0400
POSITION	44-27 N 27-18 W
COURSE AND SPEED	071 , 32.4 KNOTS
SEA STATE	5
WAVE HEIGHT	4 FEET
" REL DIR	161 PORT
SWELL HEIGHT	8 FEET
" REL DIR	64 STBD

---- VISUAL WEATHER / COMMENTS ----

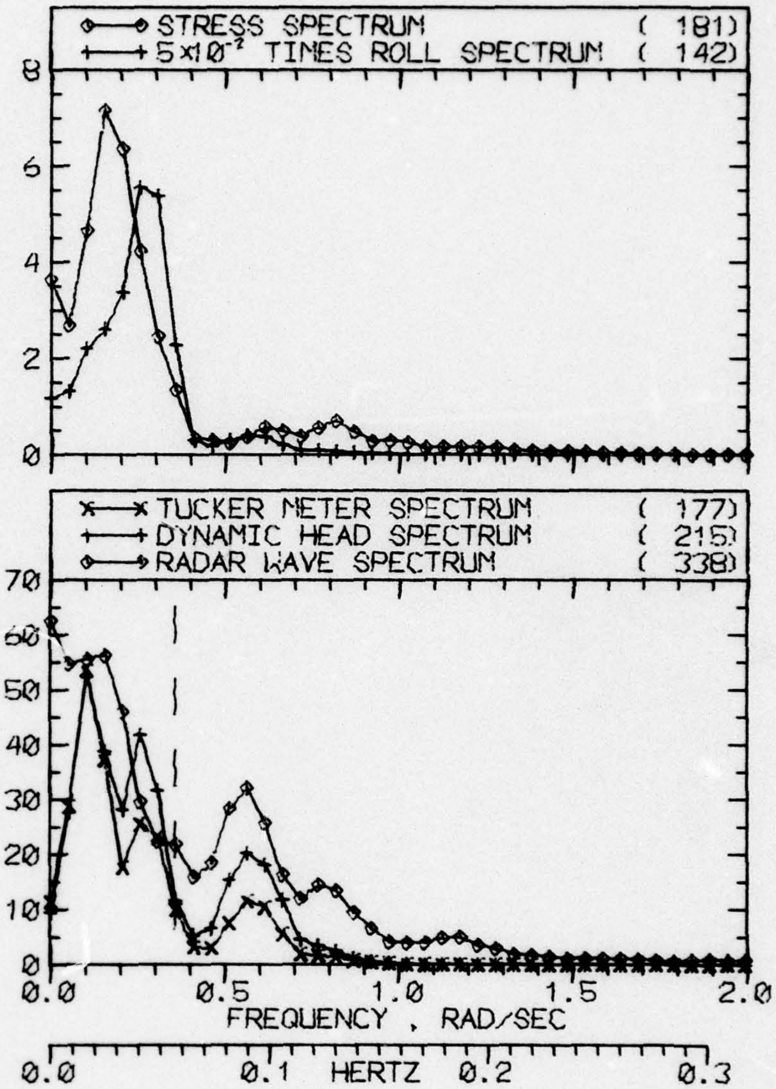
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	8.0 KPSI
4.0 X RMS	5.5 KPSI

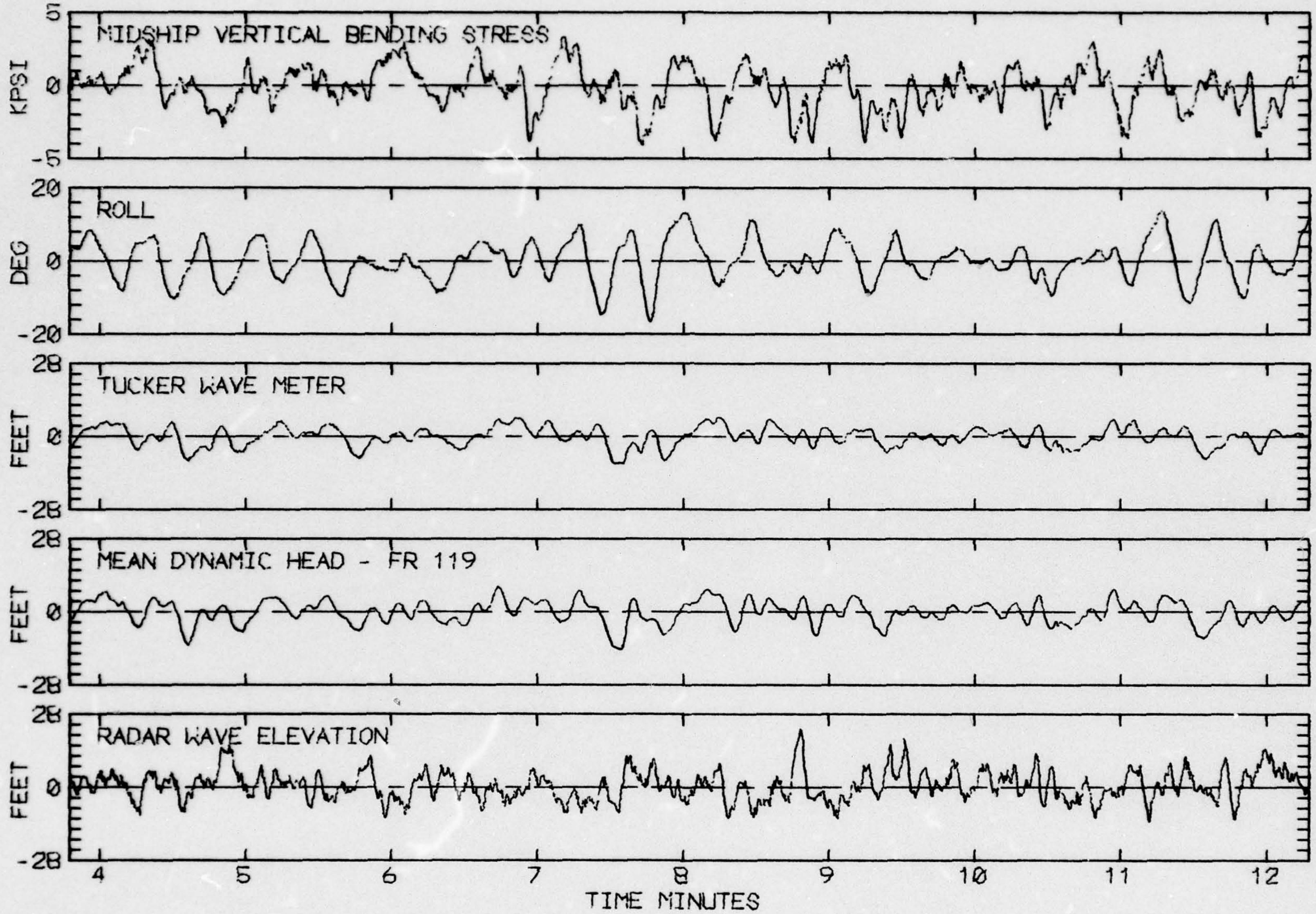
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	20.4 DEG
PITCH	1.08 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.42 G
RADAR SLANT RANGE	29.7 FEET
VERTICAL RANGE	22.6 FEET
DISPL AT RADAR	17.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	65	59	150
MAXIMUM HEIGHT	15.3	22.5	34.0
10TH HIGHEST HTS	14.2	17.8	21.3
3RD HIGHEST HTS	11.1	14.8	15.6
4.0 RMS(SPECTRA)	14.3	16.4	21.6



RUN 1134 -- VOYAGE 34E -- TAPE 159 -- INDEX 22 -- INTERVAL 34



RUN 1134 -- VOYAGE 34E -- TAPE 159 -- INDEX 22 -- INTERVAL 34

LOG BOOK DATA	
DATE AND TIME	02-02-74 0800
POSITION	44-27 N 27-18 W
COURSE AND SPEED	071 , 32.6 KNOTS
SEA STATE	3
WAVE HEIGHT	4 FEET
" REL DIR	161 PORT
SWELL HEIGHT	8 FEET
" REL DIR	64 STBD

---- VISUAL WEATHER / COMMENTS ----

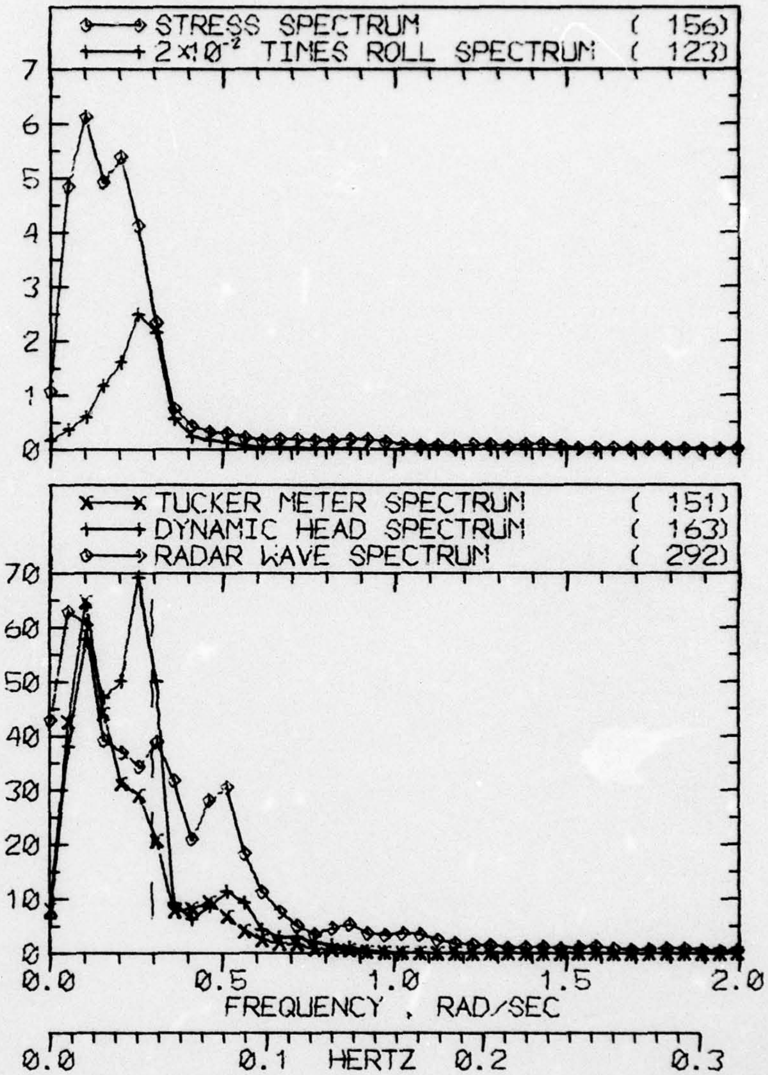
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.5 KPSI
4.0 X RMS	5.2 KPSI

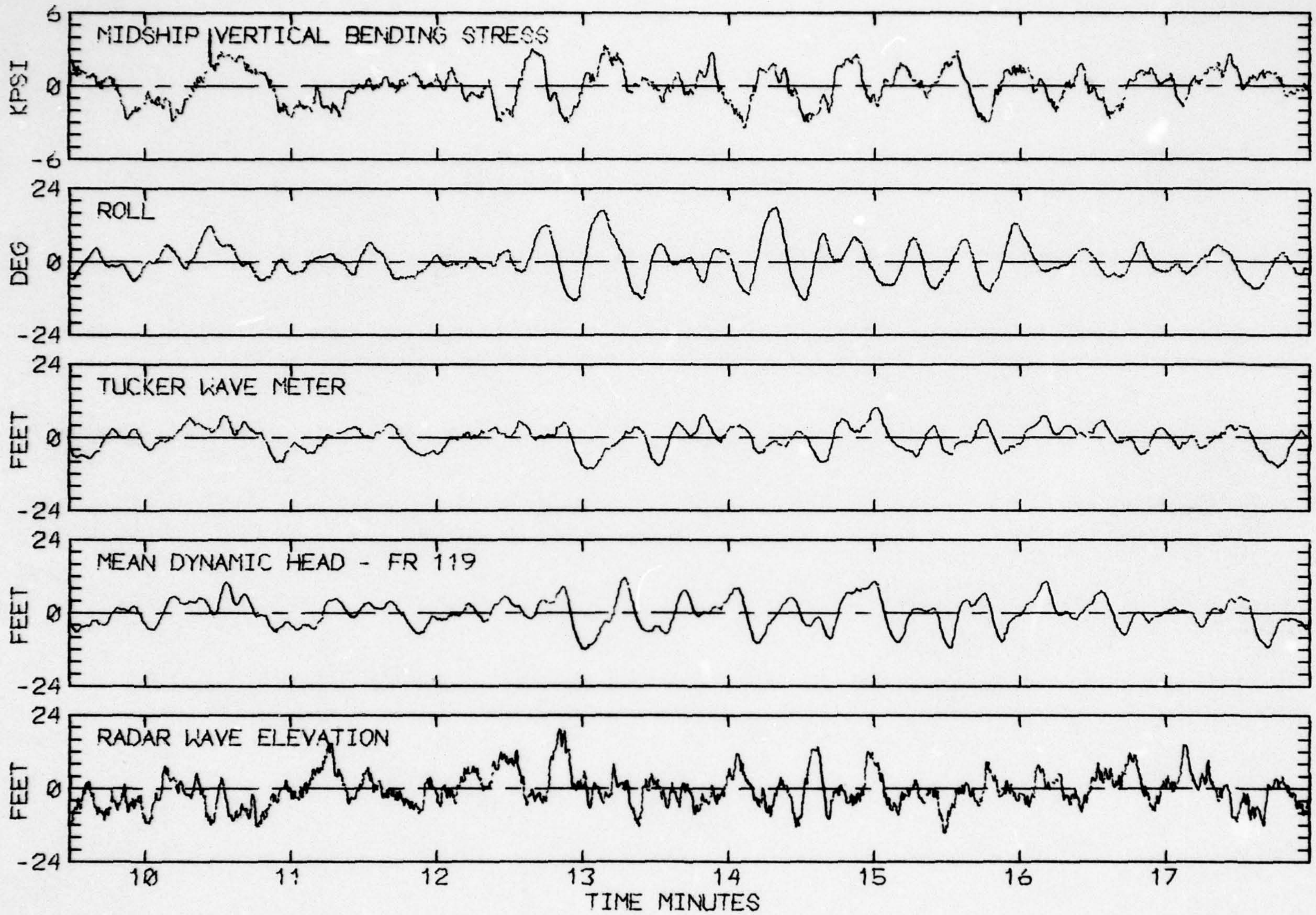
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	20.1 DEG
PITCH	0.83 DEG
DK HSE VERT ACCEL	0.18 G
DK HSE LAT ACCEL	0.43 G
RADAR SLANT RANGE	30.8 FEET
VERTICAL RANGE	20.7 FEET
DISPL AT RADAR	15.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	57	51	152
MAXIMUM HEIGHT	16.4	20.4	24.1
10TH HIGHEST HTS	14.9	18.5	18.5
3RD HIGHEST HTS	12.1	15.2	13.9
4.0 RMS(SPECTRA)	15.2	17.6	20.5



RUN 1137 -- VOYAGE 34E -- TAPE 159 -- INDEX 23 -- INTERVAL 37



RUN 1137 -- VOYAGE 34E -- TAPE 159 -- INDEX 23 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	02-02-74 1200
POSITION	48-10 N 10-20 W
COURSE AND SPEED	071 , 32.3 KNOTS
SEA STATE	5
WAVE HEIGHT	3 FEET
" REL DIR	64 STBD
SWELL HEIGHT	6 FEET
" REL DIR	64 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

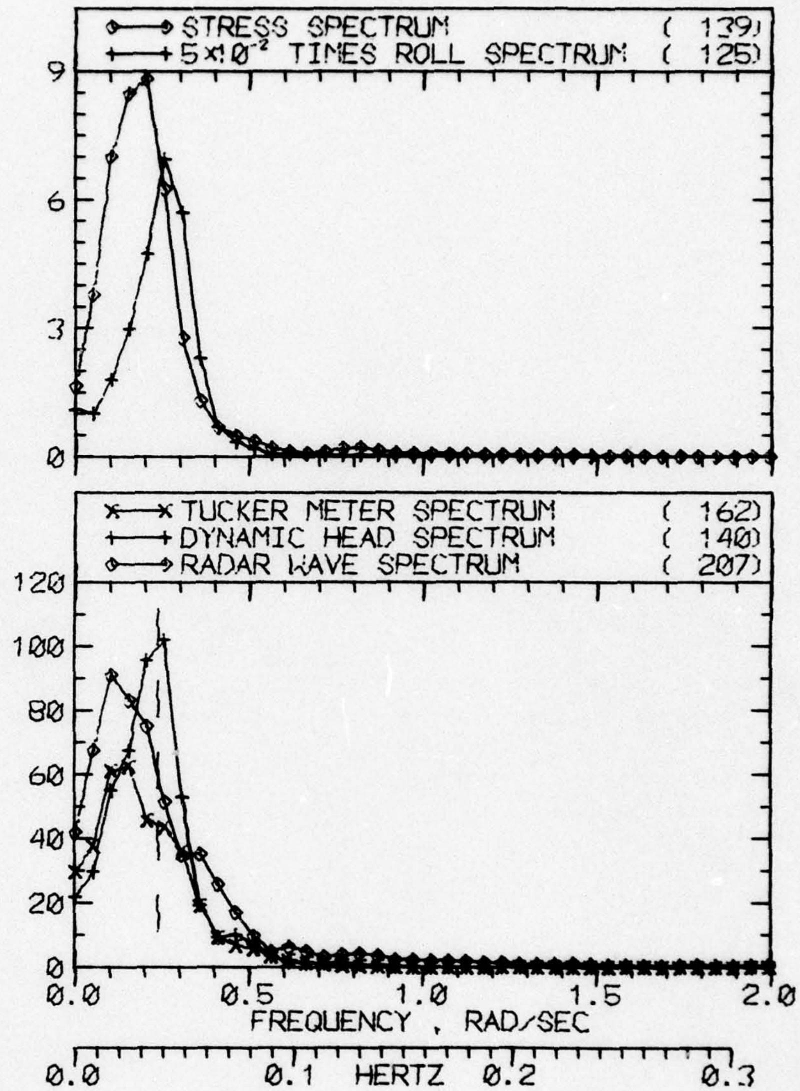
MAXIMUM PK-TR	6.9 KPSI
4.0 X RMS	5.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

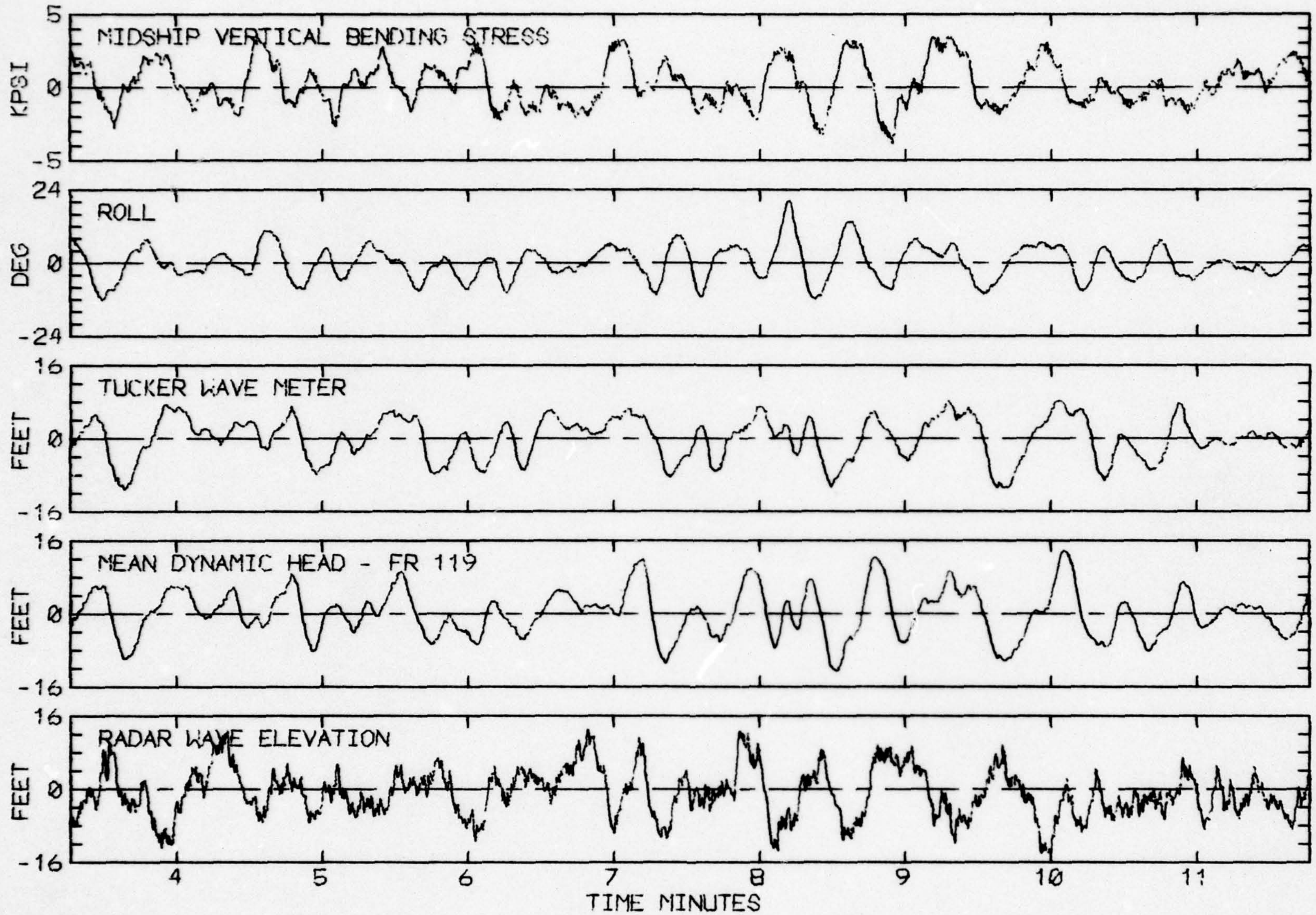
ROLL	21.3 DEG
PITCH	0.72 DEG
DK HSE VERT ACCEL	0.14 G
DK HSE LAT ACCEL	0.46 G
RADAR SLANT RANGE	30.5 FEET
VERTICAL RANGE	21.5 FEET
DISPL AT RADAR	14.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	67	45	132
MAXIMUM HEIGHT	19.4	22.6	26.5
10TH HIGHEST HTS	16.0	20.7	21.8
3RD HIGHEST HTS	12.8	18.2	14.1
4.0 RMS(SPECTRA)	17.0	19.6	21.8



RUN 1141 -- VOYAGE 34E -- TAPE 159 -- INDEX 24 -- INTERVAL 41



RUN 1141 -- VOYAGE 34E -- TAPE 159 -- INDEX 24 -- INTERVAL 41

LOG BOOK DATA	
DATE AND TIME	02-02-74 1600
POSITION	48-10 N 10-20 W
COURSE AND SPEED	071 , 32.1 KNOTS
SEA STATE	5
WAVE HEIGHT	3 FEET
" REL DIR	154 STBD
SWELL HEIGHT	8 FEET
" REL DIR	64 STBD

---- VISUAL WEATHER / COMMENTS ----

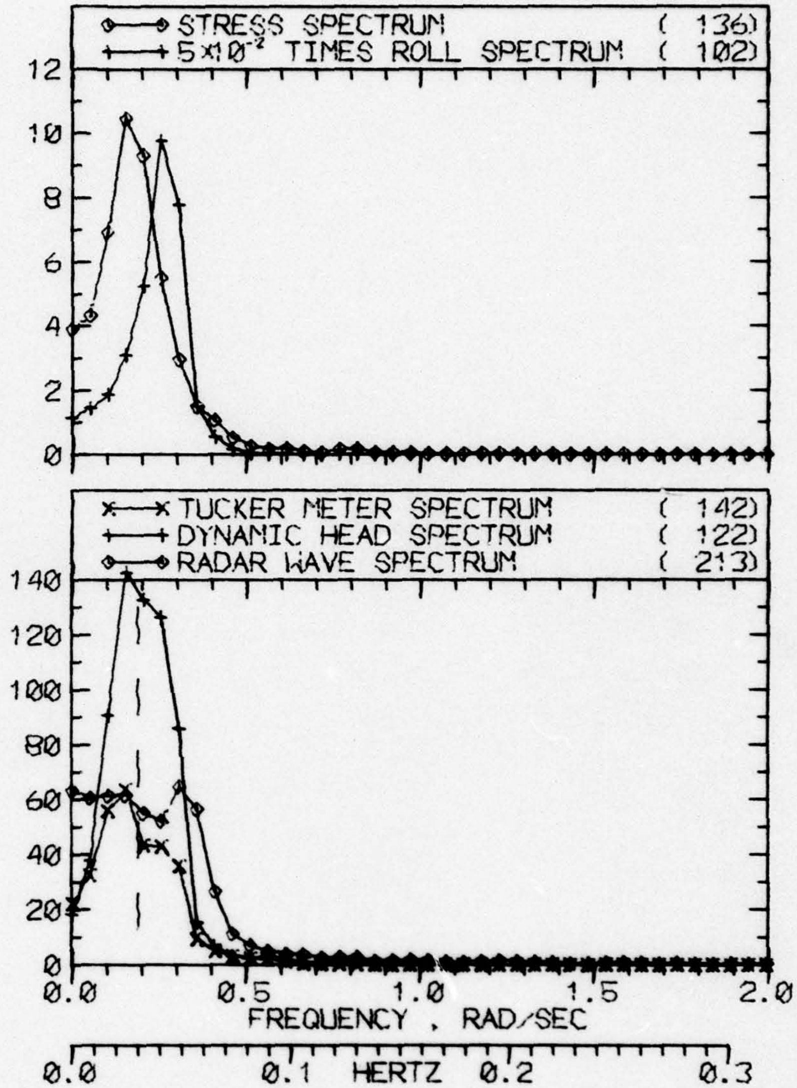
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	7.7 KPSI
4.0 X RMS	6.2 KPSI

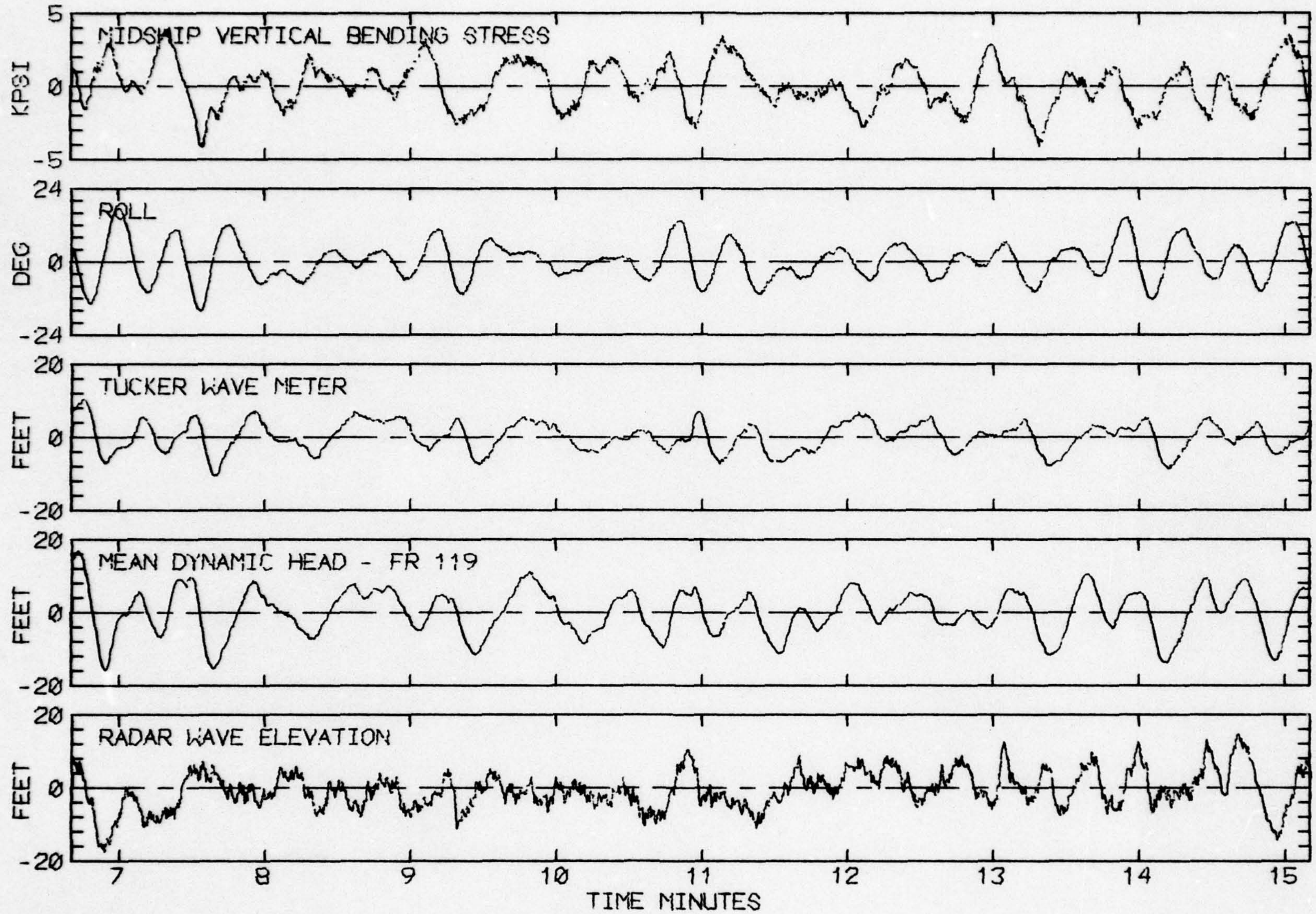
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	23.0 DEG
PITCH	0.76 DEG
DK HSE VERT ACCEL	0.10 G
DK HSE LAT ACCEL	0.51 G
RADAR SLANT RANGE	33.6 FEET
VERTICAL RANGE	20.8 FEET
DISPL AT RADAR	13.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	43	48	136
MAXIMUM HEIGHT	17.6	32.5	29.0
10TH HIGHEST HTS	16.0	24.5	19.1
3RD HIGHEST HTS	14.0	19.5	13.1
4.0 RMS(SPECTRA)	16.0	23.3	21.1



RUN 1145 -- VOYAGE 34E -- TAPE 159 -- INDEX 25 -- INTERVAL 45



RUN 1145 -- VOYAGE 34E -- TAPE 159 -- INDEX 25 -- INTERVAL 45

LOG BOOK DATA	
DATE AND TIME	02-02-74 2000
POSITION	48-10 N 10-20 W
COURSE AND SPEED	071 , 32.2 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	154 STBD
SWELL HEIGHT	1 FEET
" REL DIR	64 STBD

---- VISUAL WEATHER / COMMENTS ----

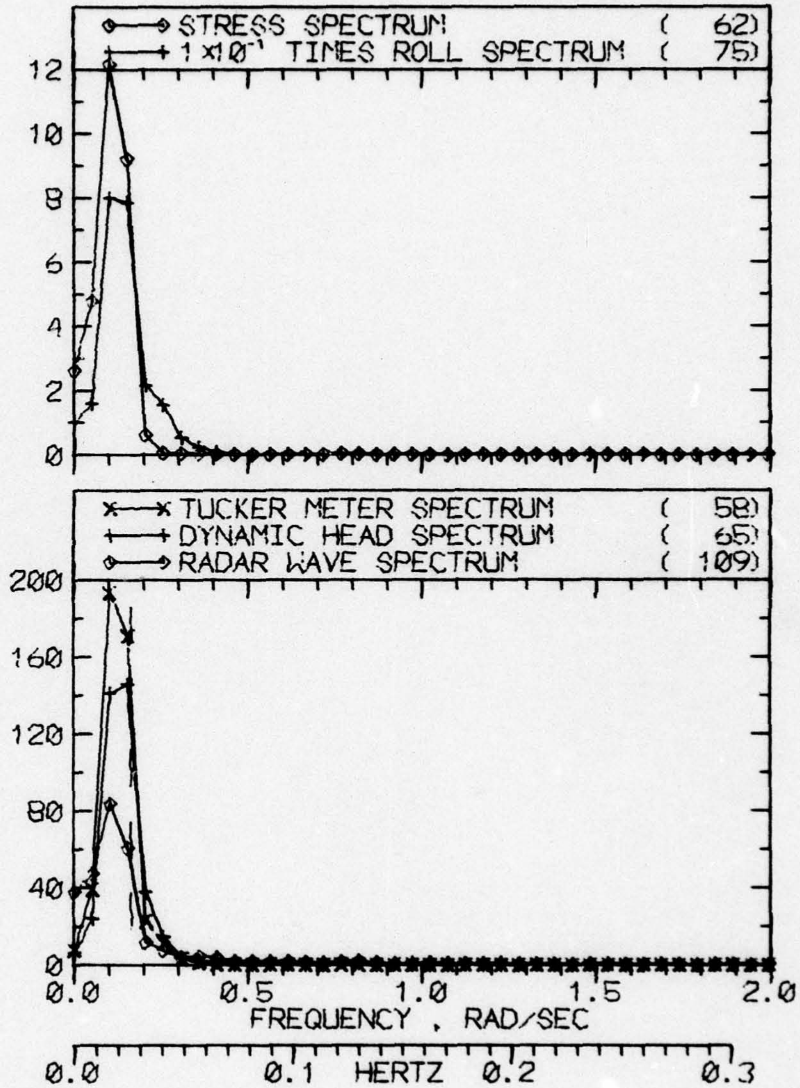
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	4.3 KPSI
4.0 X RMS	4.8 KPSI

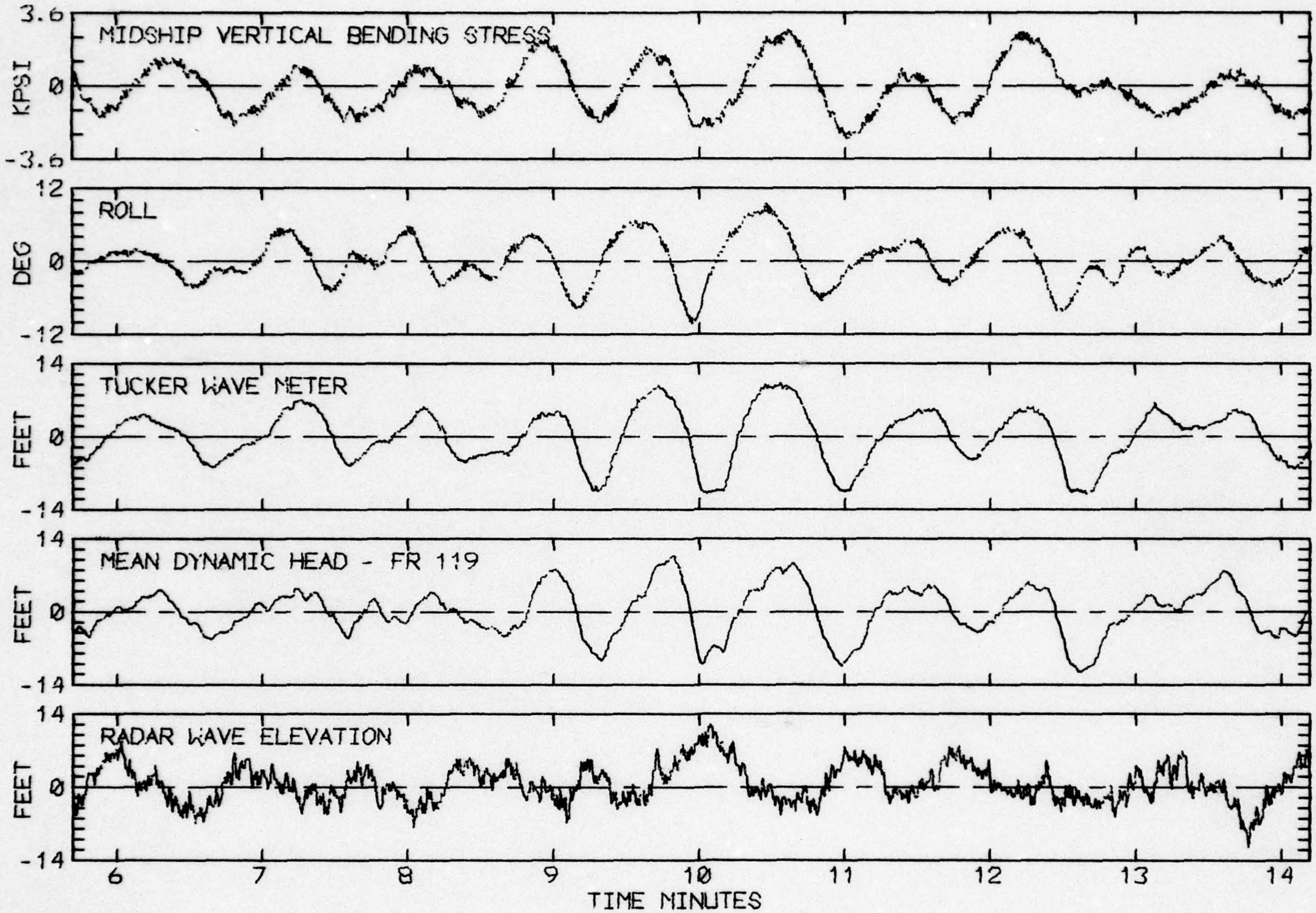
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	13.6 DEG
PITCH	0.77 DEG
DK HSE VERT ACCEL	0.04 G
DK HSE LAT ACCEL	0.27 G
RADAR SLANT RANGE	24.5 FEET
VERTICAL RANGE	15.2 FEET
DISPL AT RADAR	6.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	23	31	158
MAXIMUM HEIGHT	21.0	21.0	14.3
10TH HIGHEST HTS	20.4	19.5	10.9
3RD HIGHEST HTS	18.0	16.7	7.6
4.0 RMS(SPECTRA)	19.2	17.6	15.0



RUN 1149 -- VOYAGE 34E -- TAPE 159 -- INDEX 26 -- INTERVAL 49



RUN 1149 -- VOYAGE 34E -- TAPE 159 -- INDEX 26 -- INTERVAL 49

TABLE IIa

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
1209	161	3	9	02-06-74	0400			308	32.3	132.0	28.82	43/40
1217	161	5	17	02-06-74	1200	58-27 N	08-51 W	267	31.9	130.0	29.09	46/42
1228	161	7	28	02-06-74	2000	58-27 N	08-51 W	246	30.8	127.0	29.74	47/41
1230	161	8	30	02-06-74	2400	58-27 N	08-51 W	246	31.3	128.0	29.83	47/45
1233	161	9	33	02-07-74	0400	58-27 N	08-51 W	246	31.6	129.0	29.65	47/46
1237	161	10	37	02-07-74	0800	58-27 N	08-51 W	242	31.6	129.0	29.34	47/48
1241	161	11	41	02-07-74	1200	54-00 N	30-00 W	241	31.6	129.2	29.15	44/50
1245	161	12	45	02-07-74	1600	54-00 N	30-00 W	238	31.7	129.5	29.04	42/44
1305	163	14	5	02-07-74	2400	54-00 N	30-00 W	243	31.3	128.0	28.93	45/42
1309	163	15	9	02-08-74	0400	54-00 N	30-00 W	243	31.4	128.5	28.97	54/44
1317	163	17	17	02-08-74	1200	48-09 N	47-18 W	243	31.4	128.5	29.22	34/31
1321	163	18	21	02-08-74	1600	48-09 N	47-18 W	245	31.8	130.0	29.14	28/27
1329	163	20	29	02-08-74	2400	48-09 N	47-18 W	245	31.3	128.0	29.62	28/24
1333	163	21	33	02-09-74	0400	48-09 N	47-18 W	240	31.4	128.5	29.60	33/26
1337	163	22	37	02-09-74	0800	48-09 N	47-18 W	246	31.8	130.0	29.42	34/28
1341	163	23	41	02-09-74	1200	42-32 N	63-16 W	245	32.1	131.0	29.52	37/33
1345	163	24	45	02-09-74	1600	42-32 N	63-16 W	245	32.1	131.0	29.62	39/34

TABLE IIb

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
1209	4	83P/15	83P	1				PT CLDY /
1217	6	138S/25	138S	5	115S	8	150	OCAST /HEAVY ROLL
1228	8	136S/35	136S	5	136S	8	150	PT CLDY /HEAVY ROLL
1230	3	156P/10	156P	4	136S	6	150	PT CLDY /RIDING EASY
1233	5	100P/20	100P	2	114S	6	150	OCAST /
1237	6	118P/25	118P	2	118S	6	150	OCAST /
1241	3	106P/10	106P	3	119S	6	150	OCAST FOG RAIN /
1245	3	103P/10	103P	2	122S	6	200	OCAST /
1305	3	18P/10	18P	2	18P	6	200	PT CLDY /
1309	6	49S/25	49S	5	18P	8	150	HAIL RAIN SQUALLS /
1317	2	49S/ 5	49S	5	27S	8	150	CLEAR FOG SNOW /
1321	4	47S/15	47S	0	25S	15	200	OCAST SNOW /ICE FIELD ROLLING HIGH SWELL
1329	6	92S/25	92S	2	25S	5	150	OCAST /
1333	5	75S/20	75S	2	30S	5	150	OCAST /
1337	5	159S/20	159S	2	24S	5	150	OCAST SNOW /
1341	4	137S/15	137S	2	25S	3	200	OCAST SNOW /
1345	4	137S/15	137S	2	160S	2	300	PT CLDY /

TABLE IIc

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

D.L. RUN NO.	TMR RESULTS: NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	D.L. DIGITIZATION: RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	COLUMN RATIOS: (7) / (4)	(6) / (3+5)	(6) / (3)
1209	177	0	1.32	0.55	0.00	1.83	0.73	3.53	1.35	1.38	1.38
1217	142	44	10.16	4.85	3.30	14.62	5.21	0.01	1.07	1.09	1.44
1228	140	23	11.02	5.29	1.53	15.15	5.95	0.28	1.13	1.21	1.37
1230	145	19	9.21	4.81	2.34	12.58	5.49	1.96	1.14	1.09	1.37
1233	125	5	8.66	3.64	1.02	11.69	4.73	1.55	1.30	1.21	1.35
1237	85	34	8.34	3.83	1.33	11.69	5.19	2.05	1.36	1.21	1.40
1241	91	5	6.72	3.01	1.17	8.76	4.16	0.28	1.38	1.11	1.30
1245	137	8	8.97	4.12	1.81	12.34	4.98	1.89	1.21	1.14	1.38
1305	157	60	14.77	5.80	4.03	17.51	6.15	-0.06	1.06	0.93	1.19
1309	154	57	14.43	5.68	5.62	18.31	5.99	0.02	1.06	0.91	1.27
1317	138	43	9.26	3.87	2.10	12.14	4.70	0.06	1.21	1.07	1.31
1321	117	0	8.34	3.00	0.00	8.49	3.53	-0.04	1.17	1.02	1.02
1329	198	45	8.31	3.47	1.77	9.39	3.68	0.18	1.06	0.93	1.13
1333	181	44	10.46	4.39	3.63	13.32	4.54	0.21	1.03	0.95	1.27
1337	197	2	5.41	2.36	0.92	6.66	2.66	0.18	1.12	1.05	1.23
1341	192	0	2.87	1.10	0.00	3.20	1.22	-0.04	1.11	1.12	1.12
1345	139	2	1.84	0.86	0.81	2.99	1.22	0.10	1.42	1.13	1.62

TABLE IId

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 34 WEST

	RADAR			ROLL			PITCH			VERT ACCEL			LAT ACCEL			TUCKER		
D.L. RUN NO.	4.0 (RMS) FT	RECORDED EXTREMES FT	FT	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	4.0 (RMS) FT	RECORDED EXTREMES FT	FT
1209	9.	7.	-9.	2.0	1.	-3.	0.6	-0.0	-0.9	0.09	0.1	-0.1	0.06	0.1	-0.0	2.	2.	-2.
1217	50.	59.	-52.	17.6	7.	-19.	1.8	1.2	-2.3	0.42	0.4	-0.4	0.39	0.4	-0.3	15.	10.	-10.
1228	56.	46.	-52.	18.0	10.	-16.	1.9	1.0	-2.1	0.43	0.3	-0.3	0.39	0.3	-0.3	19.	11.	-11.
1230	43.	32.	-46.	15.7	9.	-14.	1.6	0.9	-1.9	0.35	0.3	-0.3	0.34	0.3	-0.2	14.	11.	-8.
1233	36.	30.	-40.	14.5	8.	-15.	1.0	0.4	-1.7	0.23	0.2	-0.2	0.30	0.3	-0.2	15.	11.	-9.
1237	30.	25.	-23.	9.8	10.	-8.	0.9	0.3	-1.4	0.19	0.2	-0.2	0.22	0.2	-0.2	9.	8.	-5.
1241	25.	22.	-19.	8.9	5.	-8.	0.9	0.3	-1.4	0.18	0.1	-0.2	0.20	0.2	-0.2	8.	8.	-7.
1245	31.	26.	-25.	8.3	5.	-7.	1.3	0.5	-2.0	0.27	0.2	-0.3	0.18	0.1	-0.1	9.	7.	-6.
1305	44.	33.	-44.	8.0	5.	-7.	2.2	1.7	-2.4	0.50	0.4	-0.4	0.19	0.2	-0.2	9.	7.	-7.
1309	43.	40.	-43.	10.1	8.	-9.	2.1	1.7	-2.3	0.47	0.5	-0.4	0.23	0.2	-0.2	9.	9.	-8.
1317	40.	33.	-47.	16.2	9.	-16.	1.3	0.6	-1.9	0.30	0.3	-0.3	0.35	0.3	-0.3	14.	10.	-9.
1321	33.	31.	-20.	16.5	7.	-16.	0.7	0.0	-1.3	0.15	0.1	-0.1	0.36	0.3	-0.2	13.	11.	-7.
1329	25.	26.	-25.	4.0	-1.	-8.	1.2	0.5	-2.1	0.28	0.3	-0.2	0.11	0.1	-0.1	5.	4.	-3.
1333	35.	31.	-47.	4.6	2.	-6.	1.8	1.2	-2.2	0.41	0.4	-0.4	0.12	0.1	-0.1	4.	4.	-4.
1337	19.	15.	-16.	3.9	2.	-6.	1.0	0.4	-1.8	0.23	0.2	-0.2	0.09	0.1	-0.1	4.	3.	-4.
1341	11.	13.	-10.	2.8	-0.	-5.	0.7	-0.0	-1.3	0.12	0.1	-0.1	0.07	0.1	-0.1	3.	2.	-2.
1345	12.	15.	-11.	5.3	1.	-8.	0.6	-0.0	-1.1	0.07	0.1	-0.1	0.12	0.1	-0.1	6.	5.	-4.

LOG BOOK DATA	
DATE AND TIME	02-06-74 0400
POSITION	
COURSE AND SPEED	308 , 32.3 KNOTS
SEA STATE	4
WAVE HEIGHT	1 FEET
" REL DIR	83 PORT
SWELL HEIGHT	FEET
" REL DIR	

---- VISUAL WEATHER / COMMENTS ----

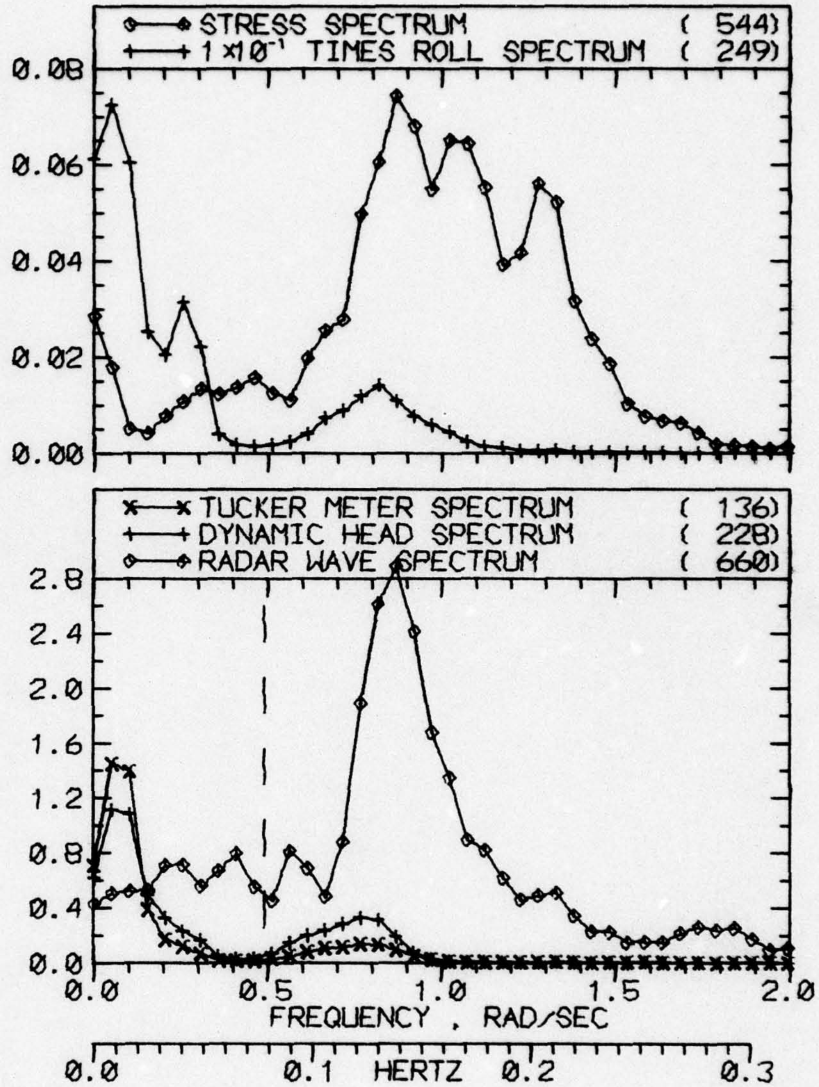
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	1.3 KPSI
4.0 X RMS	1.0 KPSI

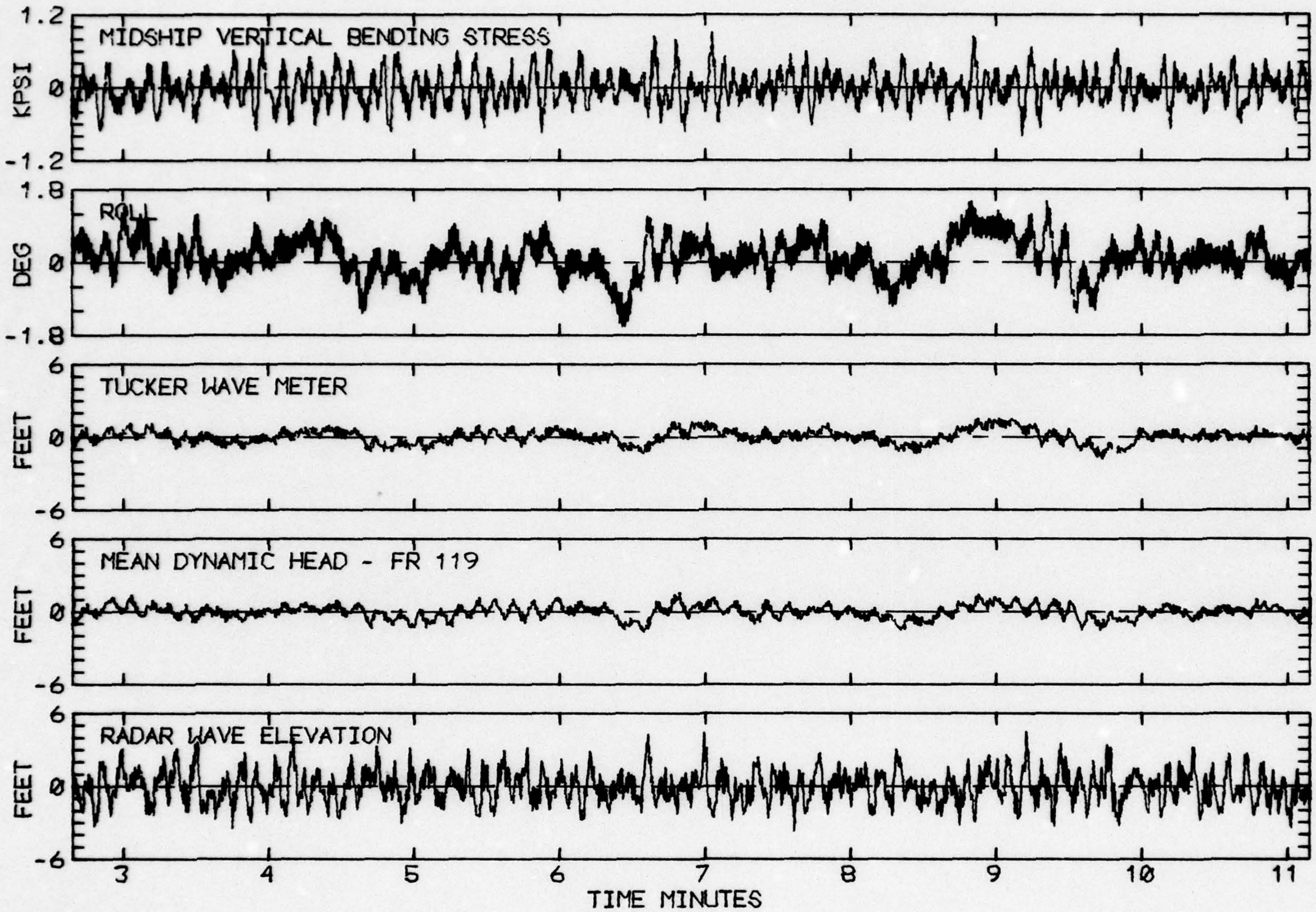
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	1.9 DEG
PITCH	0.59 DEG
DK HSE VERT ACCEL	0.09 G
DK HSE LAT ACCEL	0.06 G
RADAR SLANT RANGE	8.7 FEET
VERTICAL RANGE	7.7 FEET
DISPL AT RADAR	3.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	507	355	428
MAXIMUM HEIGHT	2.1	2.1	7.1
10TH HIGHEST HTS	1.3	1.6	5.5
3RD HIGHEST HTS	0.9	1.1	4.2
4.0 RMS(SPECTRA)	2.1	2.3	5.4



RUN 1209 -- VOYAGE 34W -- TAPE 161 -- INDEX 3 -- INTERVAL 9



RUN 1209 -- VOYAGE 34W -- TAPE 161 -- INDEX 3 -- INTERVAL 9

LOG BOOK DATA	
DATE AND TIME	02-06-74 1200
POSITION	58-27 N 08-51 W
COURSE AND SPEED	267 , 31.9 KNOTS
SEA STATE	6
WAVE HEIGHT	5 FEET
" REL DIR	138 STBD
SWELL HEIGHT	8 FEET
" REL DIR	115 STBD

---- VISUAL WEATHER / COMMENTS ----

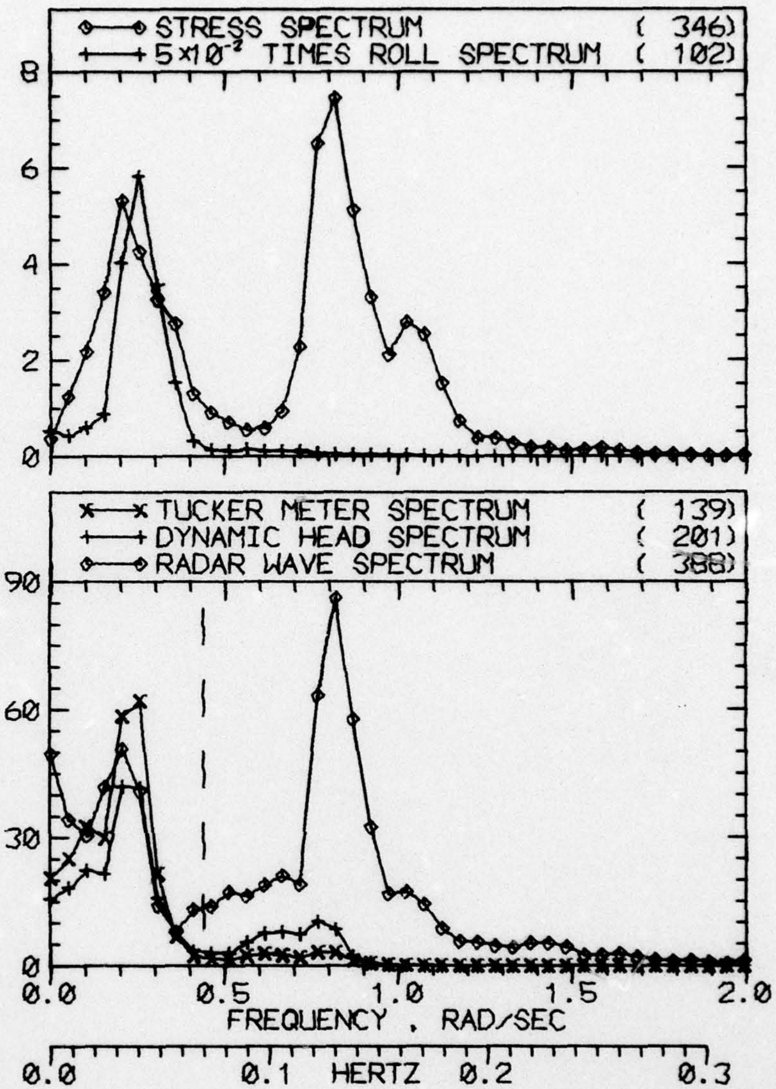
OCAST /HEAVY ROLL

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	10.2 KPSI
4.0 X RMS	7.3 KPSI

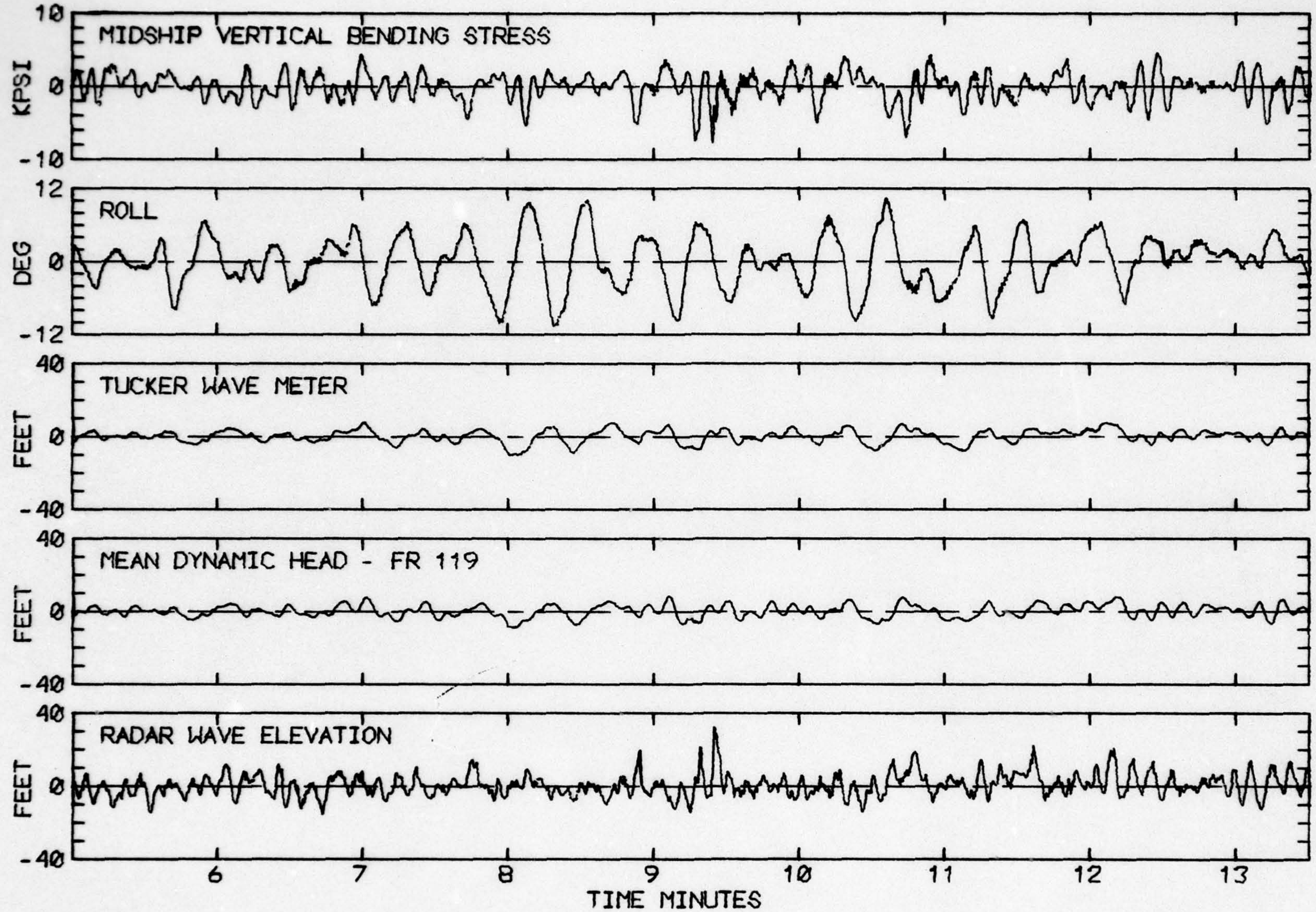
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	17.4 DEG
PITCH	1.81 DEG
DK HSE VERT ACCEL	0.42 G
DK HSE LAT ACCEL	0.39 G
RADAR SLANT RANGE	49.6 FEET
VERTICAL RANGE	36.9 FEET
DISPL AT RADAR	22.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	74	76	174
MAXIMUM HEIGHT	14.7	14.9	37.5
10TH HIGHEST HTS	13.9	13.5	26.7
3RD HIGHEST HTS	10.3	10.6	20.1
4.0 RMS(SPECTRA)	14.9	14.0	24.7



RUN 1217 -- VOYAGE 34W -- TAPE 161 -- INDEX 5 -- INTERVAL 17



RUN 1217 -- VOYAGE 34W -- TAPE 161 -- INDEX 5 -- INTERVAL 17

LOG BOOK DATA	
DATE AND TIME	02-06-74 2000
POSITION	58-27 N 08-51 W
COURSE AND SPEED	246 , 30.8 KNOTS
SEA STATE	8
WAVE HEIGHT	5 FEET
" REL DIR	136 STBD
SWELL HEIGHT	8 FEET
" REL DIR	136 STBD

---- VISUAL WEATHER / COMMENTS ----

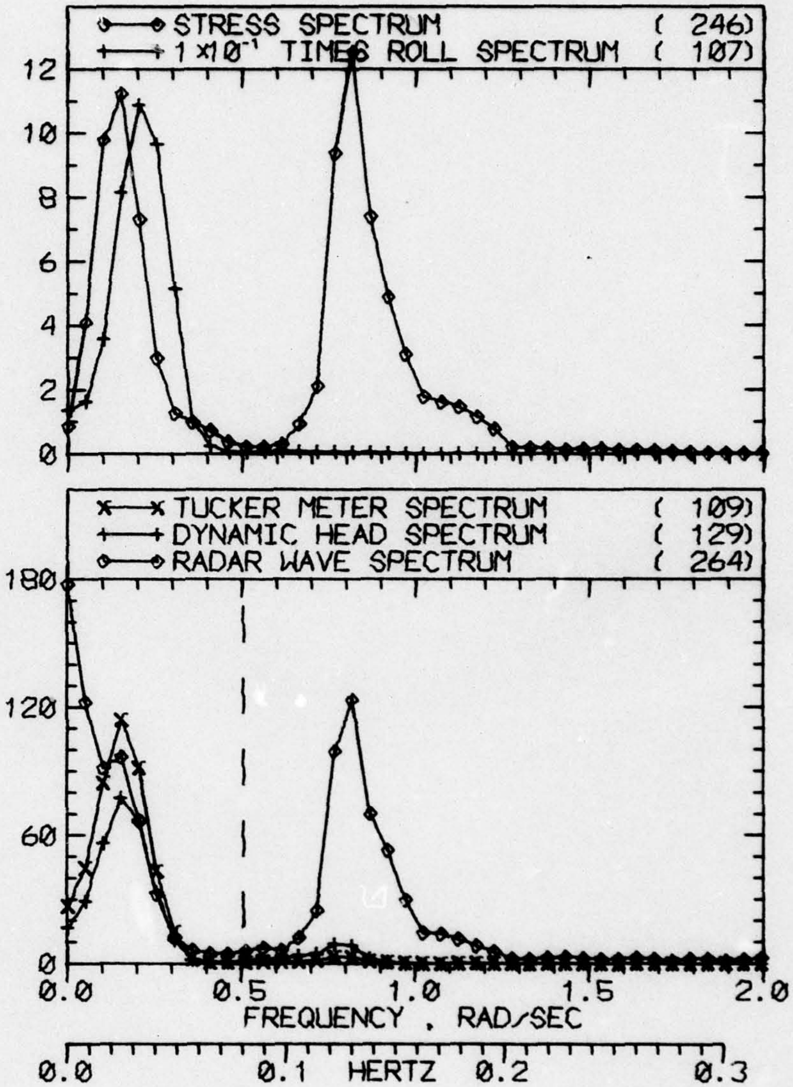
PT CLDY /HEAVY ROLL

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	11.0 KPSI
4.0 X RMS	8.6 KPSI

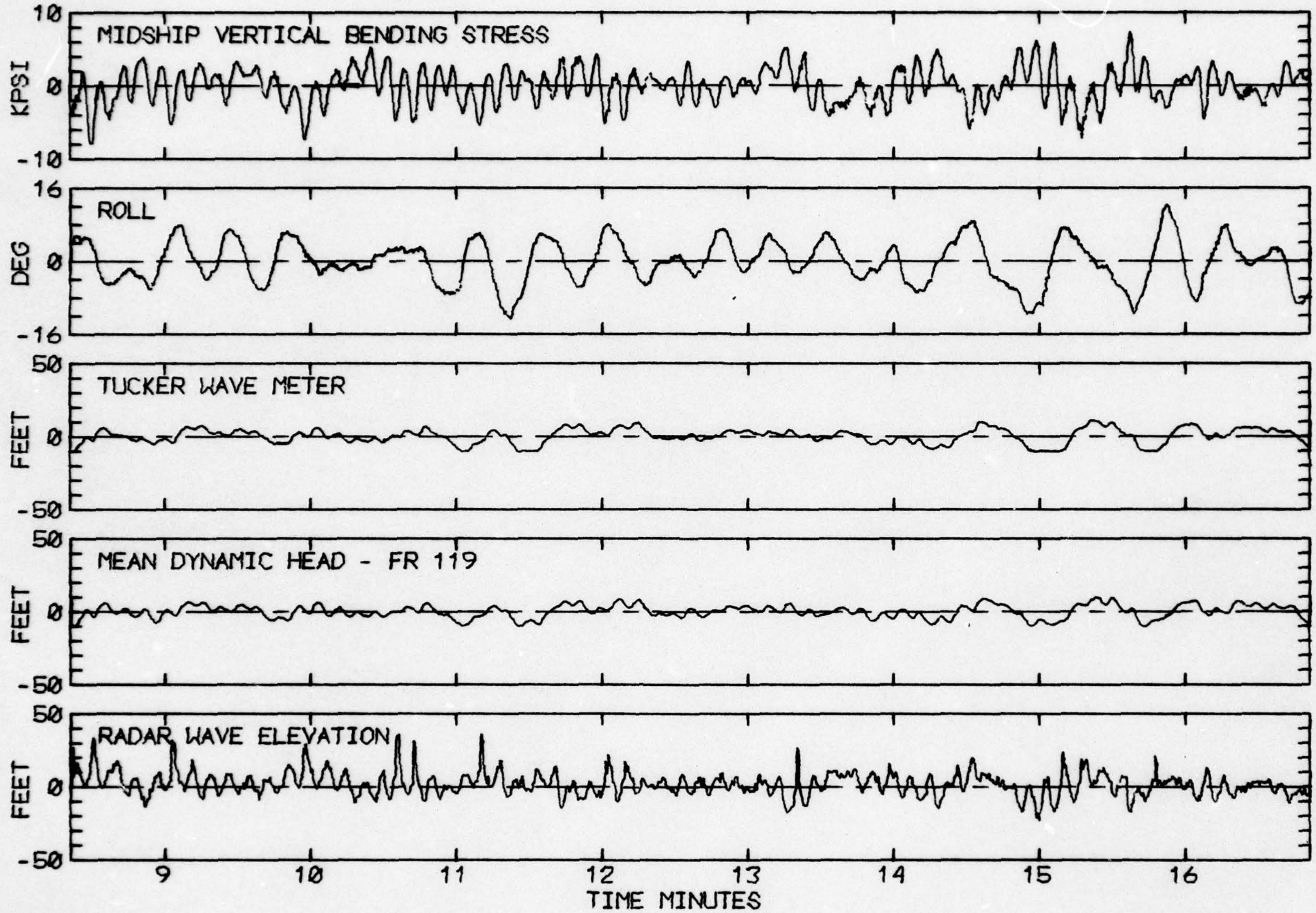
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	18.5 DEG
PITCH	1.92 DEG
DK HSE VERT ACCEL	0.43 G
DK HSE LAT ACCEL	0.39 G
RADAR SLANT RANGE	55.7 FEET
VERTICAL RANGE	43.5 FEET
DISPL AT RADAR	21.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	/DYN. HEAD	/RADAR
P-T SAMPLE SIZE	50	62	147
MAXIMUM HEIGHT	21.0	18.5	43.7
10TH HIGHEST HTS	18.2	16.3	33.1
3RD HIGHEST HTS	13.7	12.3	25.0
4.0 RMS(SPECTRA)	18.6	16.2	29.8



RUN 1228 -- VOYAGE 34W -- TAPE 161 -- INDEX 7 -- INTERVAL 28



RUN 1228 -- VOYAGE 34W -- TAPE 161 -- INDEX 7 -- INTERVAL 28

LOG BOOK DATA	
DATE AND TIME	02-06-74 2400
POSITION	58-27 N 08-51 W
COURSE AND SPEED	246 . 31.3 KNOTS
SEA STATE	3
WAVE HEIGHT	4 FEET
" REL DIR	156 PORT
SWELL HEIGHT	6 FEET
" REL DIR	136 STBD

---- VISUAL WEATHER / COMMENTS ----

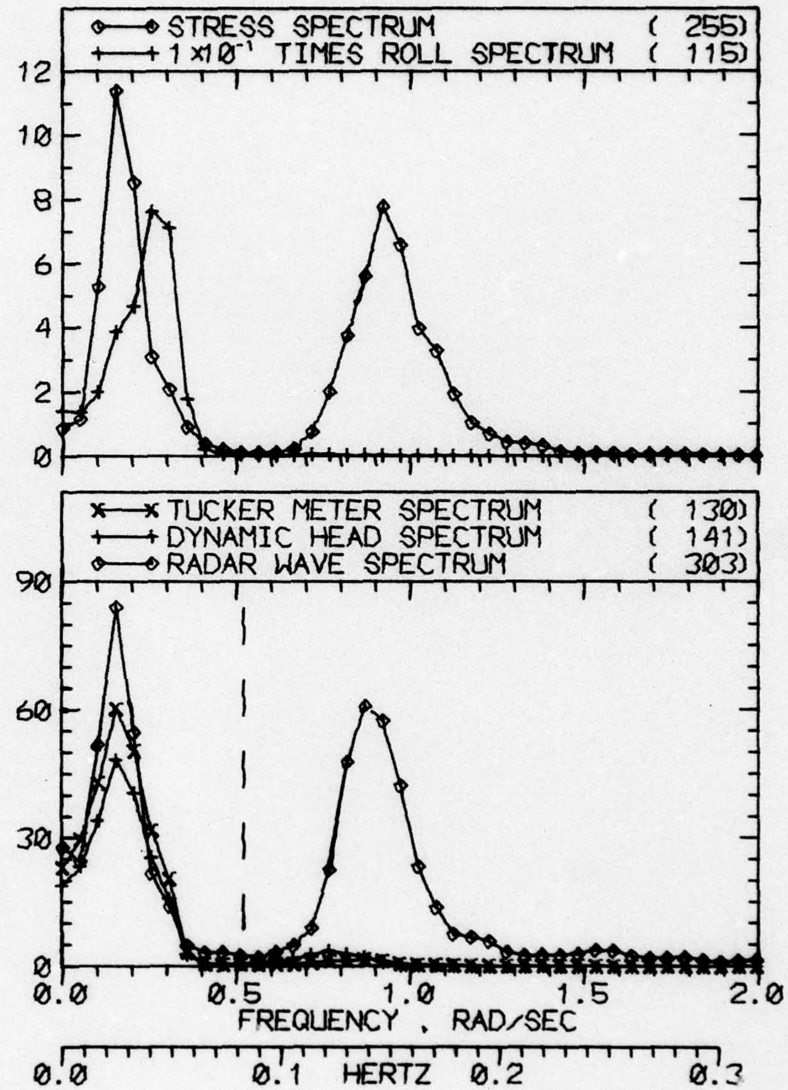
PT CLDY /RIDING EASY

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	9.2 KPSI
4.0 X RMS	7.8 KPSI

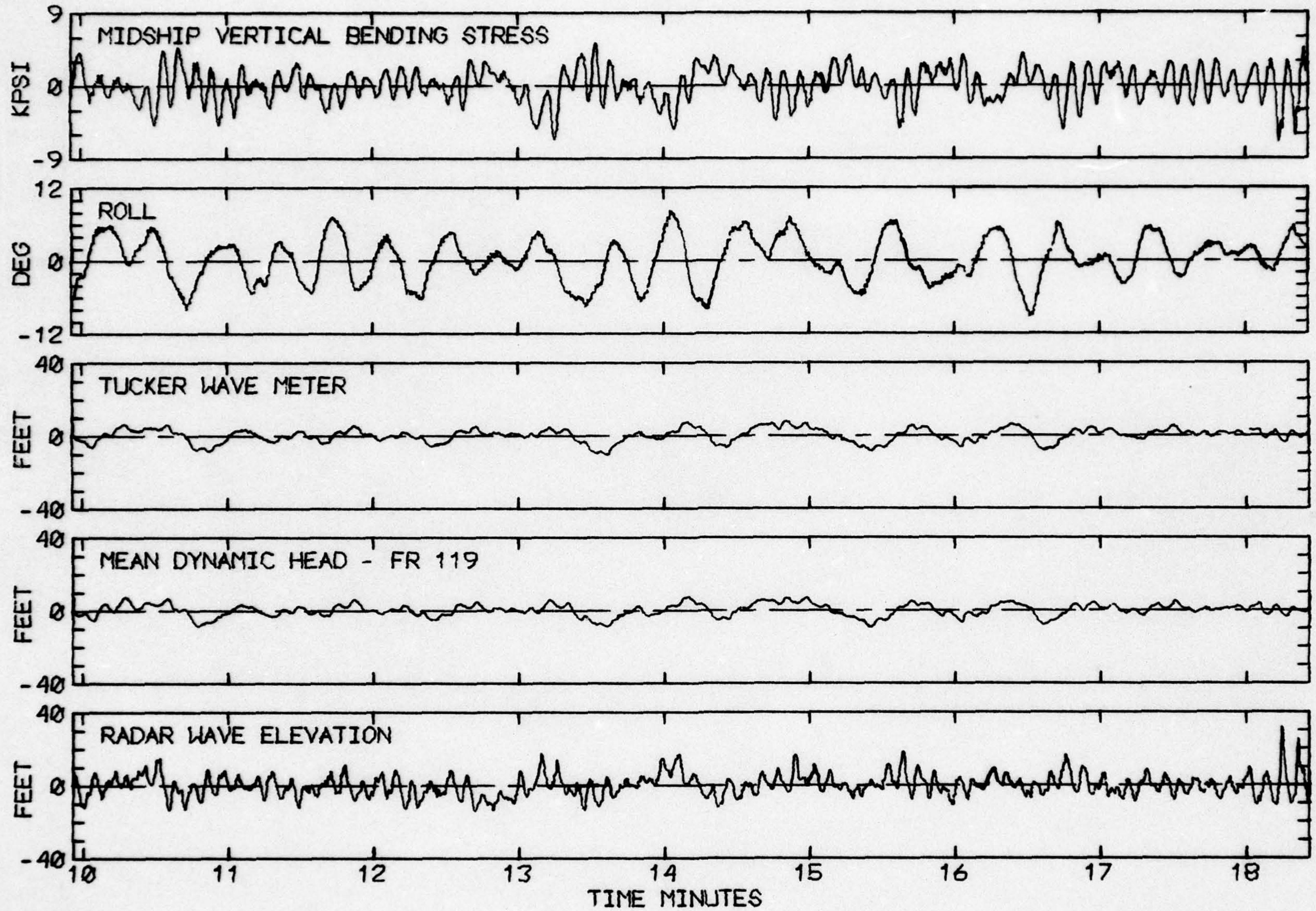
SUMMARY OF MOTIONS (4.0 X RMS)		
ROLL	15.6	DEG
PITCH	1.61	DEG
DK HSE VERT ACCEL	0.35	G
DK HSE LAT ACCEL	0.34	G
RADAR SLANT RANGE	43.2	FEET
VERTICAL RANGE	33.2	FEET
DISPL AT RADAR	15.6	FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	62	65	157
MAXIMUM HEIGHT	15.0	16.3	41.9
10TH HIGHEST HTS	14.0	13.4	25.1
3RD HIGHEST HTS	10.7	10.0	19.5
4.0 RMS(SPECTRA)	14.6	13.4	22.9



RUN 1230 -- VOYAGE 34W -- TAPE 161 -- INDEX 8 -- INTERVAL 30



RUN 1230 -- VOYAGE 34W -- TAPE 161 -- INDEX 8 -- INTERVAL 30

LOG BOOK DATA

DATE AND TIME	02-07-74 0400
POSITION	58-27 N 08-51 W
COURSE AND SPEED	246 . 31.6 KNOTS
SEA STATE	5
WAVE HEIGHT	2 FEET
" REL DIR	100 PORT
SWELL HEIGHT	6 FEET
" REL DIR	114 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

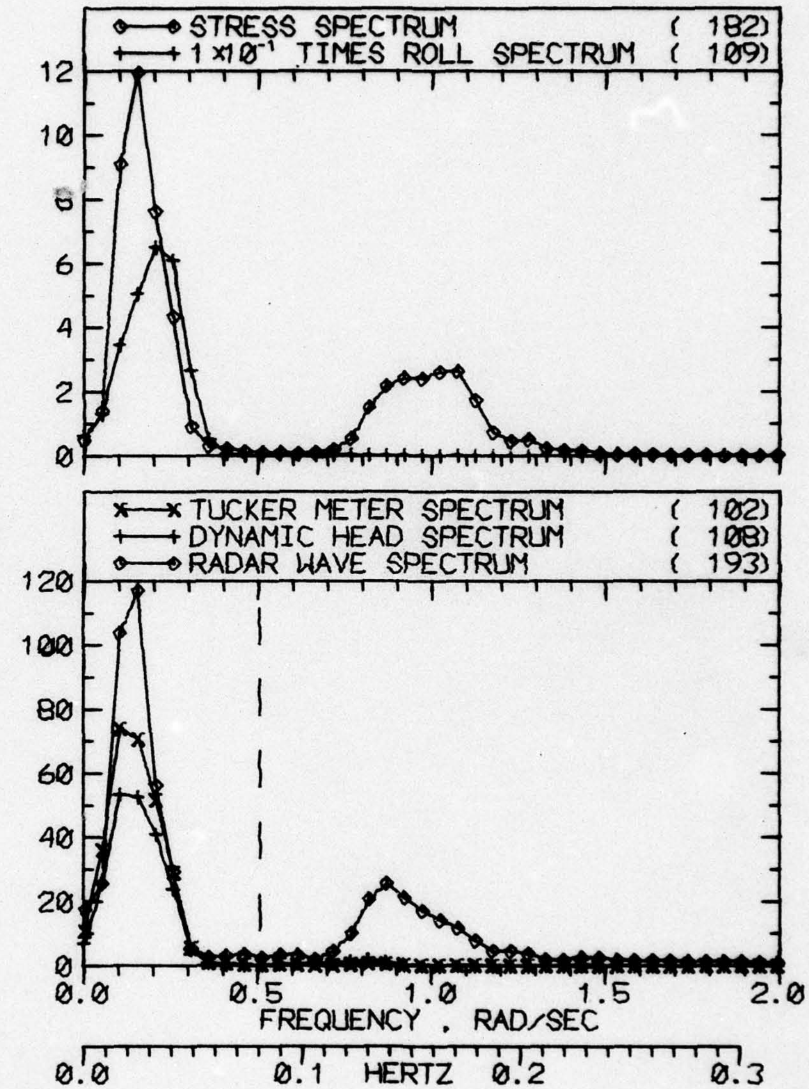
MAXIMUM PK-TR	8.7 KPSI
4.0 X RMS	6.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

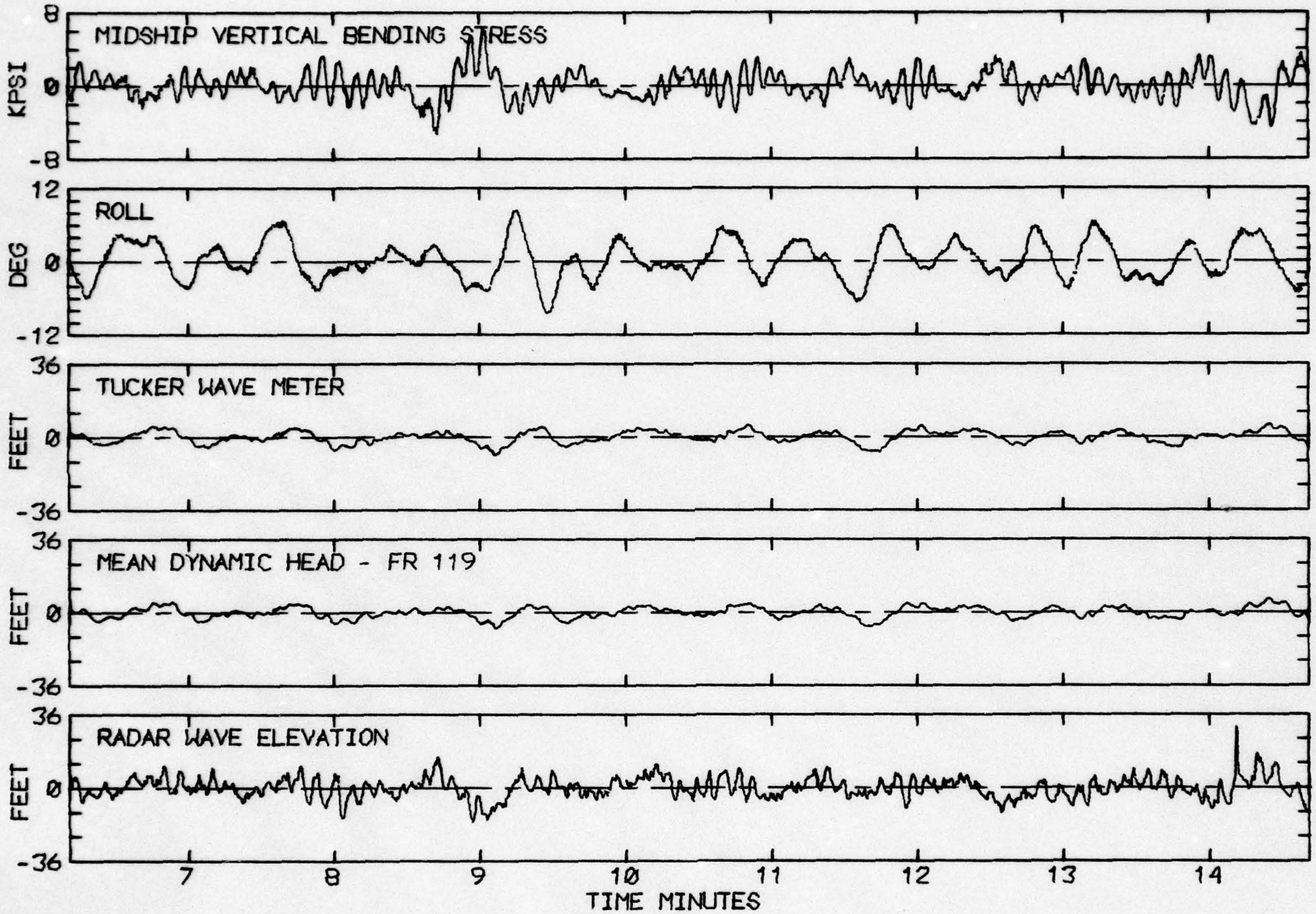
ROLL	14.7 DEG
PITCH	1.04 DEG
DK HSE VERT ACCEL	0.23 G
DK HSE LAT ACCEL	0.30 G
RADAR SLANT RANGE	36.1 FEET
VERTICAL RANGE	26.1 FEET
DISPL AT RADAR	9.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	80	68	148
MAXIMUM HEIGHT	13.5	14.3	30.1
10TH HIGHEST HTS	11.9	11.8	20.3
3RD HIGHEST HTS	7.7	8.2	15.5
4.0 RMS(SPECTRA)	15.2	13.3	21.3



RUN 1233 -- VOYAGE 34W -- TAPE 161 -- INDEX 9 -- INTERVAL 33



RUN 1233 -- VOYAGE 34W -- TAPE 161 -- INDEX 9 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	02-07-74 0800
POSITION	58-27 N 08-51 W
COURSE AND SPEED	242 , 31.6 KNOTS
SEA STATE	6
WAVE HEIGHT	2 FEET
" REL DIR	118 PORT
SWELL HEIGHT	6 FEET
" REL DIR	118 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

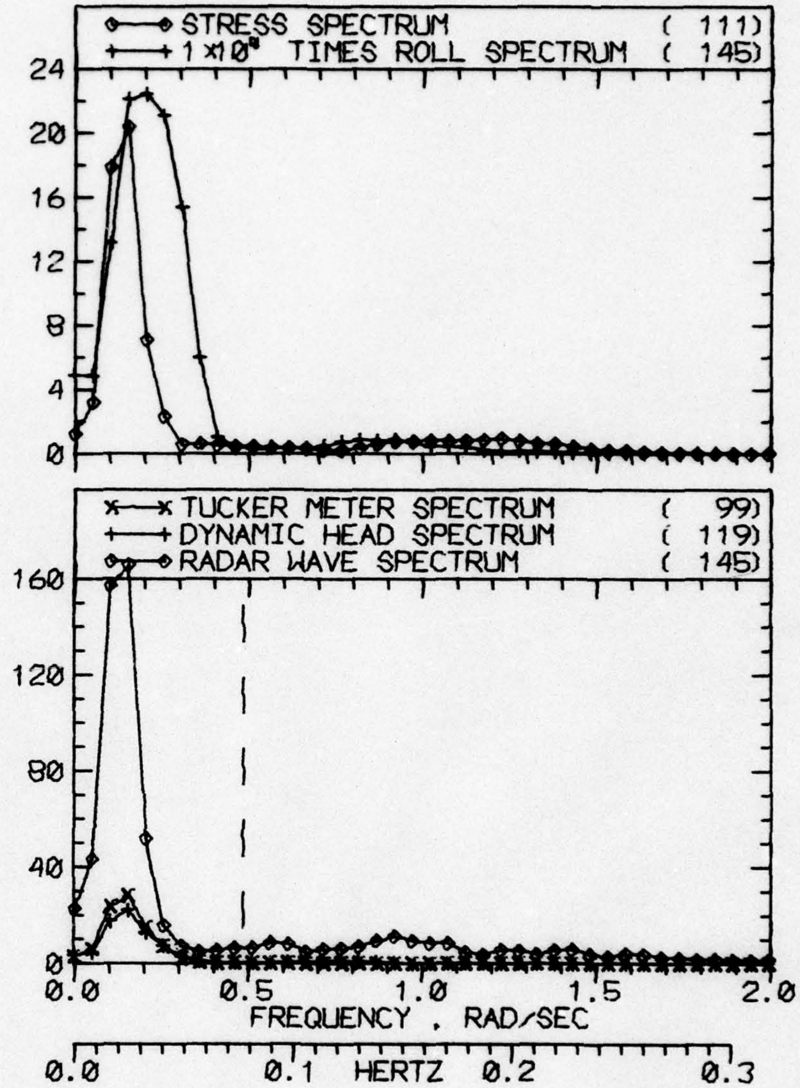
MAXIMUM PK-TR	8.3 KPSI
4.0 X RMS	7.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

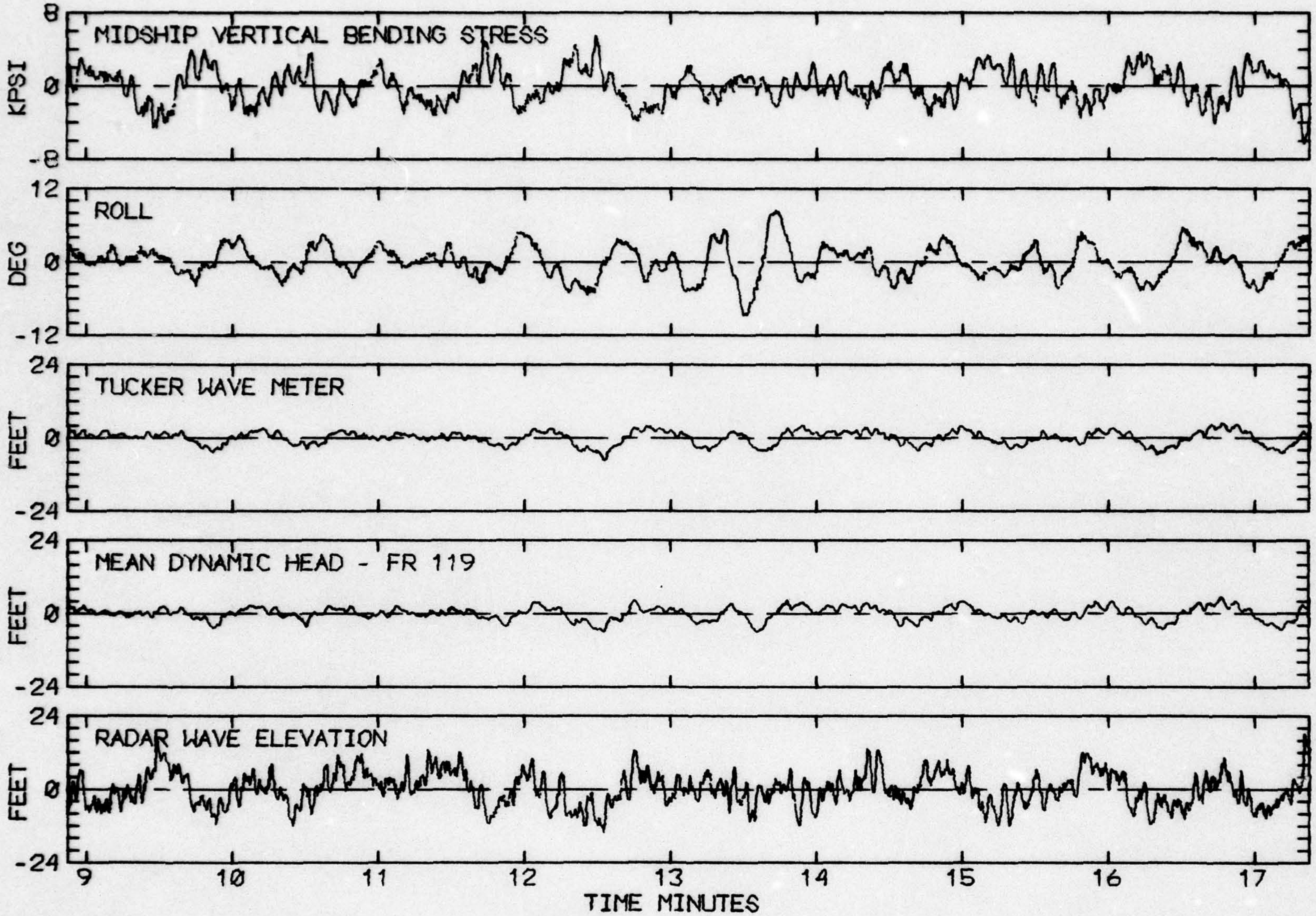
ROLL	9.8 DEG
PITCH	0.94 DEG
DK HSE VERT ACCEL	0.19 G
DK HSE LAT ACCEL	0.22 G
RADAR SLANT RANGE	30.2 FEET
VERTICAL RANGE	25.6 FEET
DISPL AT RADAR	8.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	128	116	151
MAXIMUM HEIGHT	11.1	10.7	28.0
10TH HIGHEST HTS	7.1	7.1	19.2
3RD HIGHEST HTS	4.4	4.7	15.3
4.0 RMS(SPECTRA)	8.7	8.1	23.1



RUN 1237 -- VOYAGE 34W -- TAPE 161 -- INDEX 10 -- INTERVAL 37



RUN 1237 -- VOYAGE 34W -- TAPE 161 -- INDEX 10 -- INTERVAL 37

LOG BOOK DATA	
DATE AND TIME	02-07-74 1200
POSITION	54-00 N 30-00 W
COURSE AND SPEED	241 , 31.6 KNOTS
SEA STATE	3
WAVE HEIGHT	3 FEET
" REL DIR	106 PORT
SWELL HEIGHT	6 FEET
" REL DIR	119 STBD

---- VISUAL WEATHER / COMMENTS ----

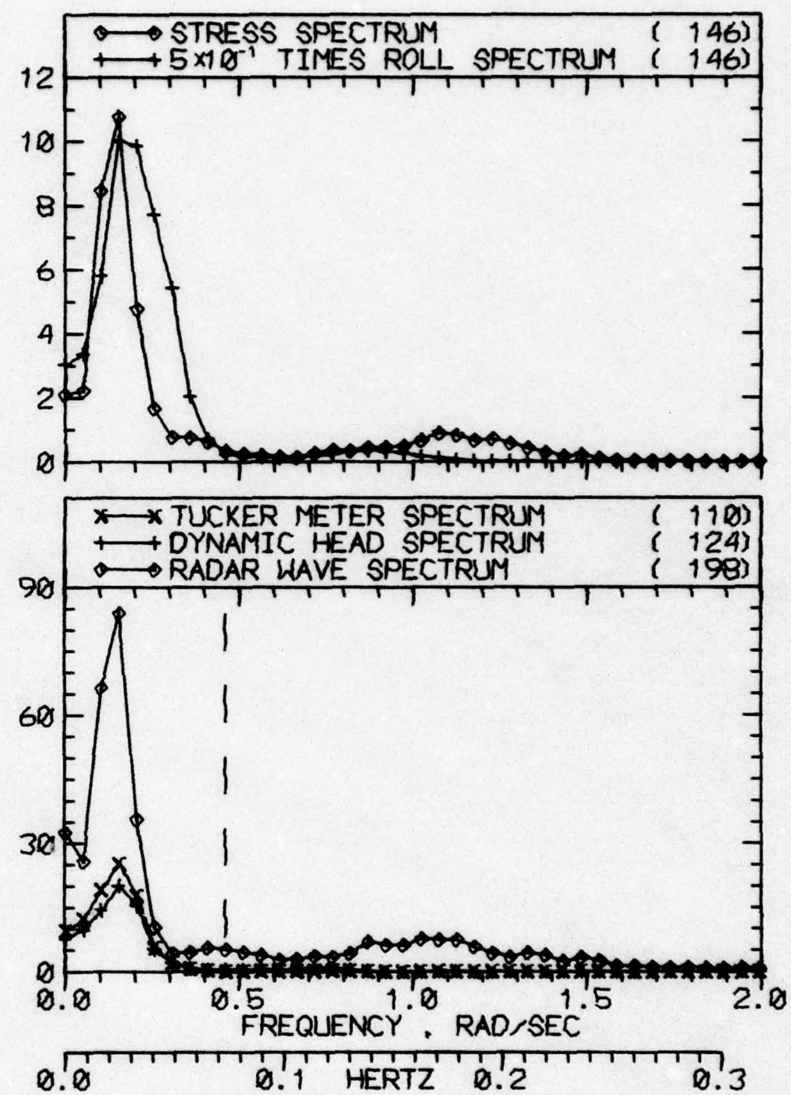
OCAST FOG RAIN /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	6.7 KPSI
4.0 X RMS	5.8 KPSI

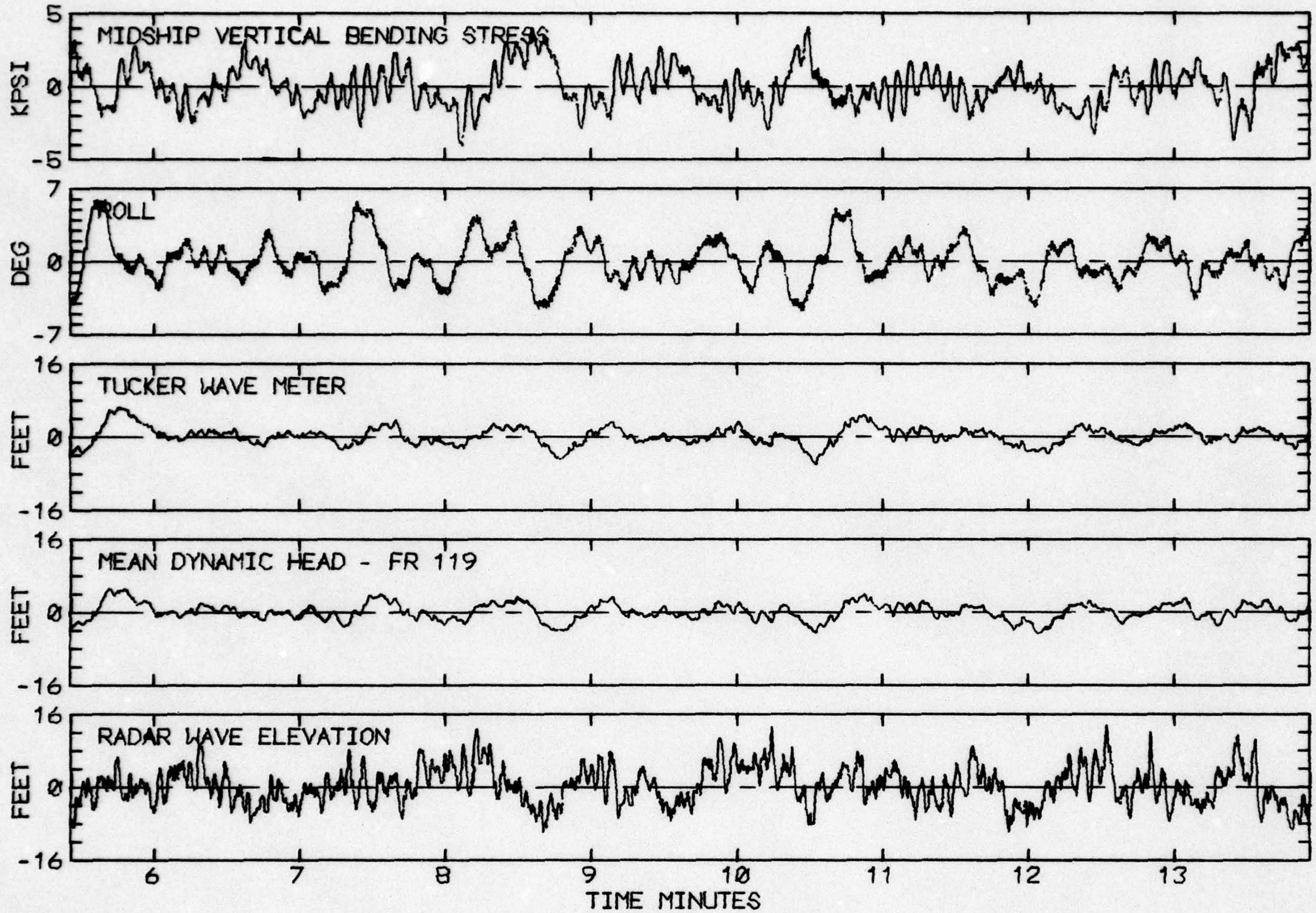
SUMMARY OF MOTIONS (4.0 X RMS)		
ROLL	9.0	DEG
PITCH	0.87	DEG
DK HSE VERT ACCEL	0.18	G
DK HSE LAT ACCEL	0.20	G
RADAR SLANT RANGE	25.1	FEET
VERTICAL RANGE	20.2	FEET
DISPL AT RADAR	7.7	FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	113	104	179
MAXIMUM HEIGHT	7.9	10.4	19.0
10TH HIGHEST HTS	6.3	6.6	14.3
3RD HIGHEST HTS	4.2	4.6	11.5
4.0 RMS(SPECTRA)	8.7	8.1	17.7



RUN 1241 -- VOYAGE 34W -- TAPE 161 -- INDEX 11 -- INTERVAL 41



RUN 1241 -- VOYAGE 34W -- TAPE 161 -- INDEX 11 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	02-07-74 1600
POSITION	54-00 N 30-00 W
COURSE AND SPEED	238 , 31.7 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	103 PORT
SWELL HEIGHT	6 FEET
" REL DIR	122 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

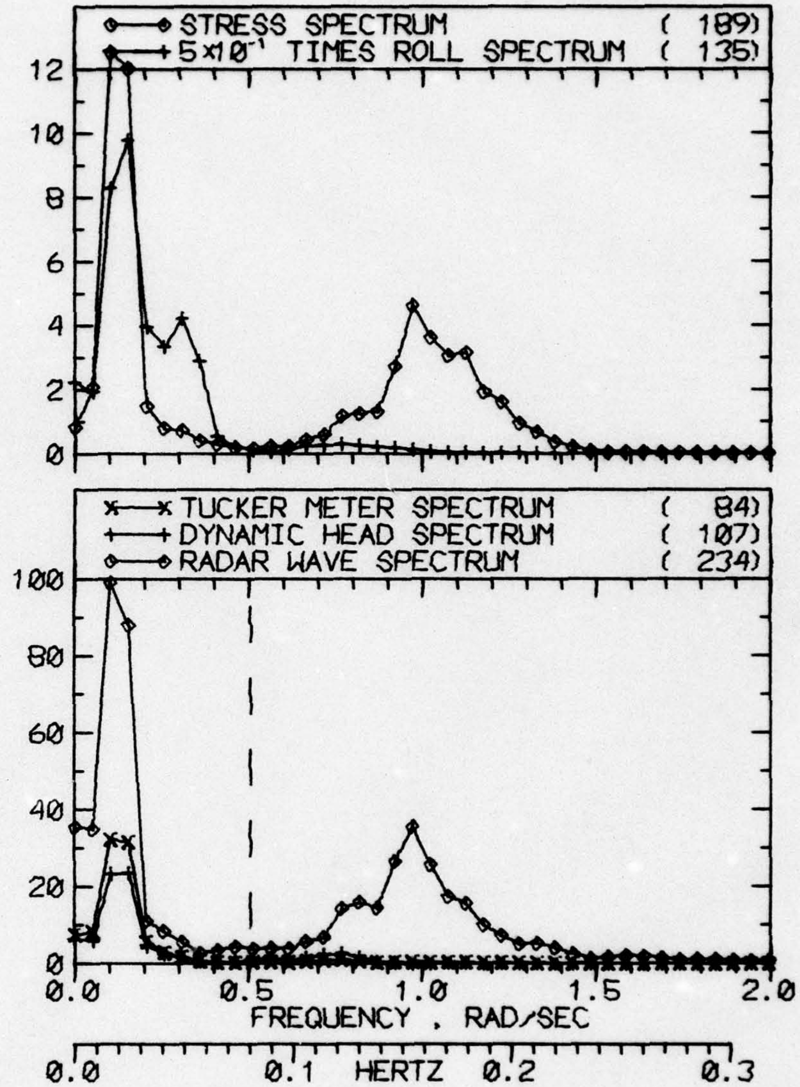
MAXIMUM PK-TR	9.0 KPSI
4.0 X RMS	7.0 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

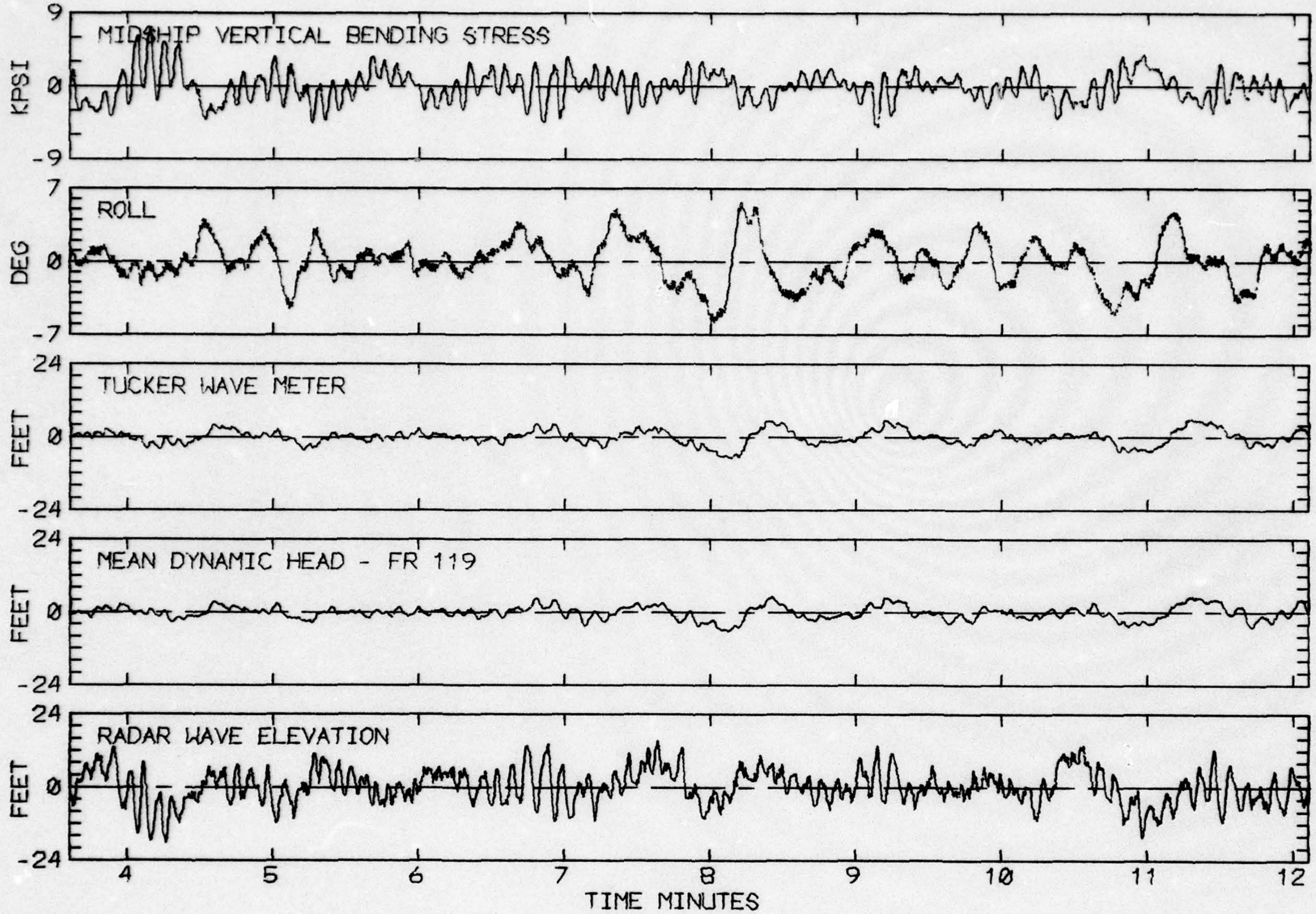
ROLL	8.0 DEG
PITCH	1.26 DEG
DK HSE VERT ACCEL	0.27 G
DK HSE LAT ACCEL	0.18 G
RADAR SLANT RANGE	30.7 FEET
VERTICAL RANGE	26.8 FEET
DISPL AT RADAR	11.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	114	117	164
MAXIMUM HEIGHT	11.5	12.1	26.5
10TH HIGHEST HTS	7.2	7.2	20.4
3RD HIGHEST HTS	4.6	4.9	15.5
4.0 RMS(SPECTRA)	8.9	8.1	20.8



RUN 1245 -- VOYAGE 34W -- TAPE 161 -- INDEX 12 -- INTERVAL 45



RUN 1245 -- VOYAGE 34W -- TAPE 161 -- INDEX 12 -- INTERVAL 45

LOG BOOK DATA	
DATE AND TIME	02-07-74 2400
POSITION	54-00 N 30-00 W
COURSE AND SPEED	243 . 31.3 KNOTS
SEA STATE	3
WAVE HEIGHT	2 FEET
" REL DIR	18 PORT
SWELL HEIGHT	6 FEET
" REL DIR	18 PORT

---- VISUAL WEATHER / COMMENTS ----

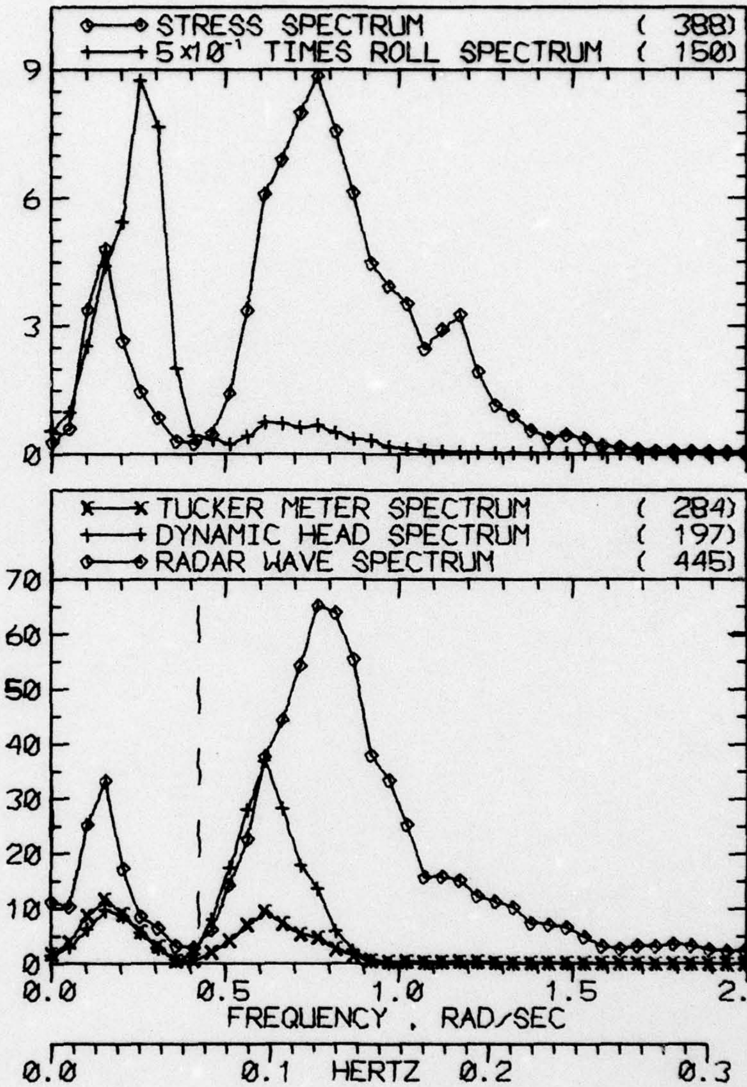
PT CLDY /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	14.8 KPSI
4.0 X RMS	8.8 KPSI

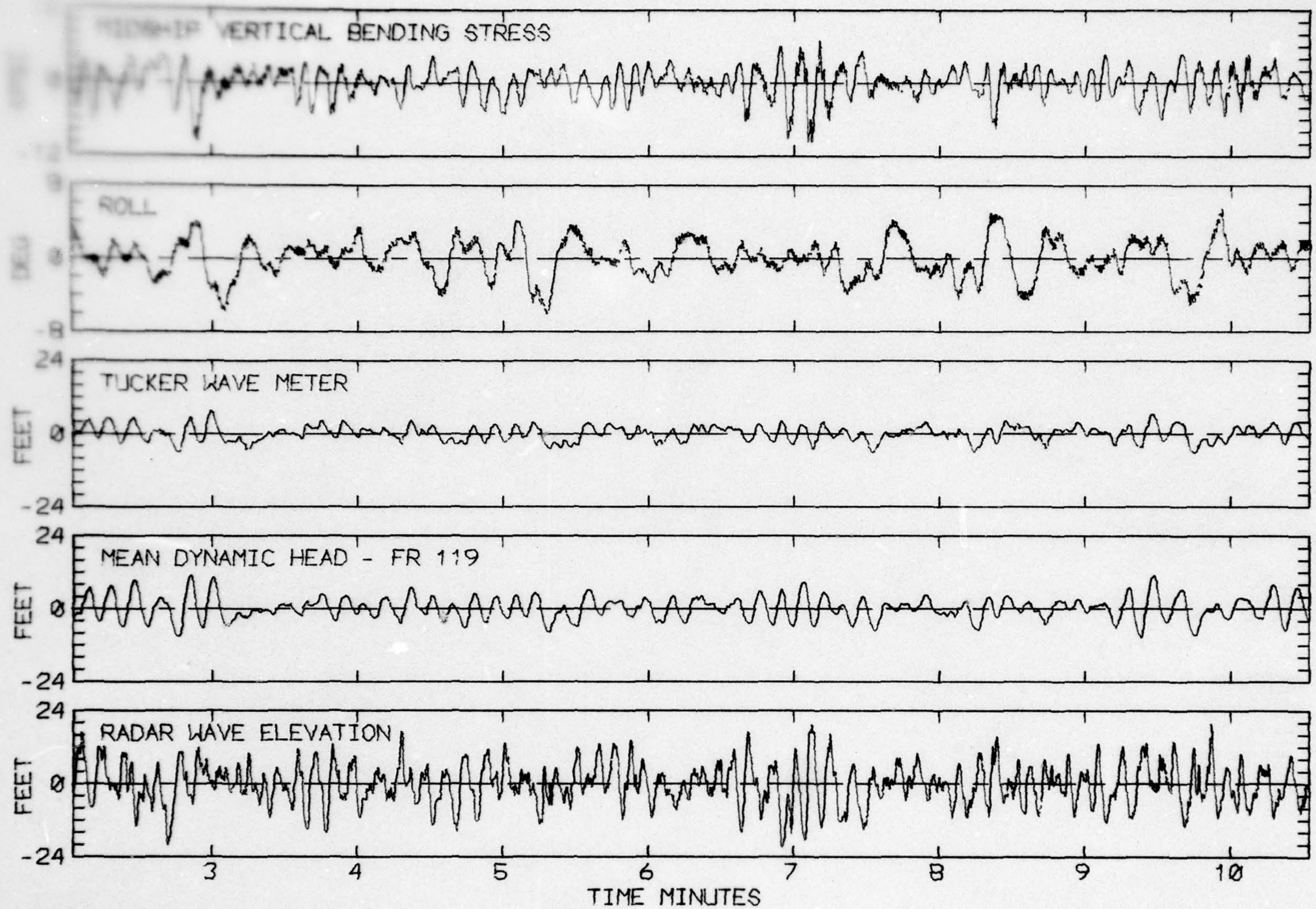
SUMMARY OF MOTIONS (4.0 X RMS)		
ROLL	8.0	DEG
PITCH	2.20	DEG
DK HSE VERT ACCEL	0.50	G
DK HSE LAT ACCEL	0.19	G
RADAR SLANT RANGE	43.5	FEET
VERTICAL RANGE	40.7	FEET
DISPL AT RADAR	29.5	FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	128	102	191
MAXIMUM HEIGHT	12.2	17.2	33.7
10TH HIGHEST HTS	9.0	15.1	29.1
3RD HIGHEST HTS	7.0	12.1	22.8
4.0 RMS(SPECTRA)	8.8	12.8	24.8



RUN 1305 -- VOYAGE 34W -- TAPE 163 -- INDEX 14 -- INTERVAL 5



RUN 1305 -- VOYAGE 34W -- TAPE 163 -- INDEX 14 -- INTERVAL 5

LOG BOOK DATA

DATE AND TIME	02-08-74 0400
POSITION	54-00 N 30-00 W
COURSE AND SPEED	243 , 31.4 KNOTS
SEA STATE	6
WAVE HEIGHT	5 FEET
" REL DIR	49 STBD
SWELL HEIGHT	8 FEET
" REL DIR	18 PORT

---- VISUAL WEATHER / COMMENTS ----

HAIL RAIN SQUALLS /

MIDSHIP VERTICAL BENDING STRESS

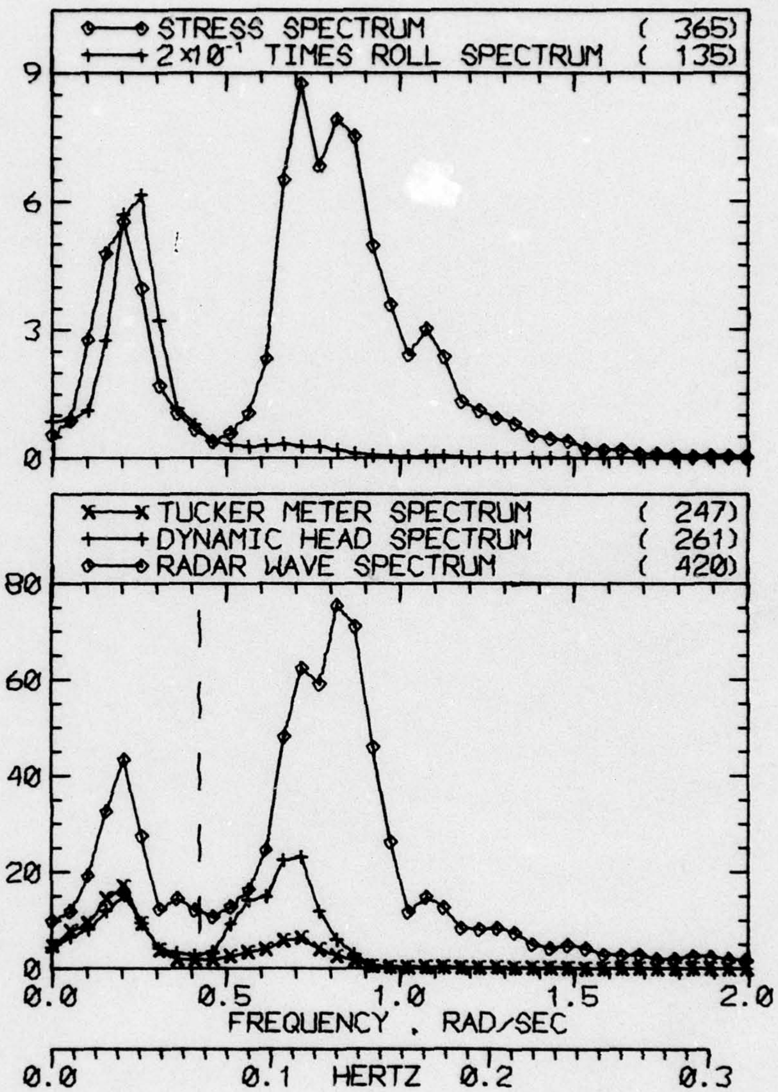
MAXIMUM PK-TR	14.4 KPSI
4.0 X RMS	8.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

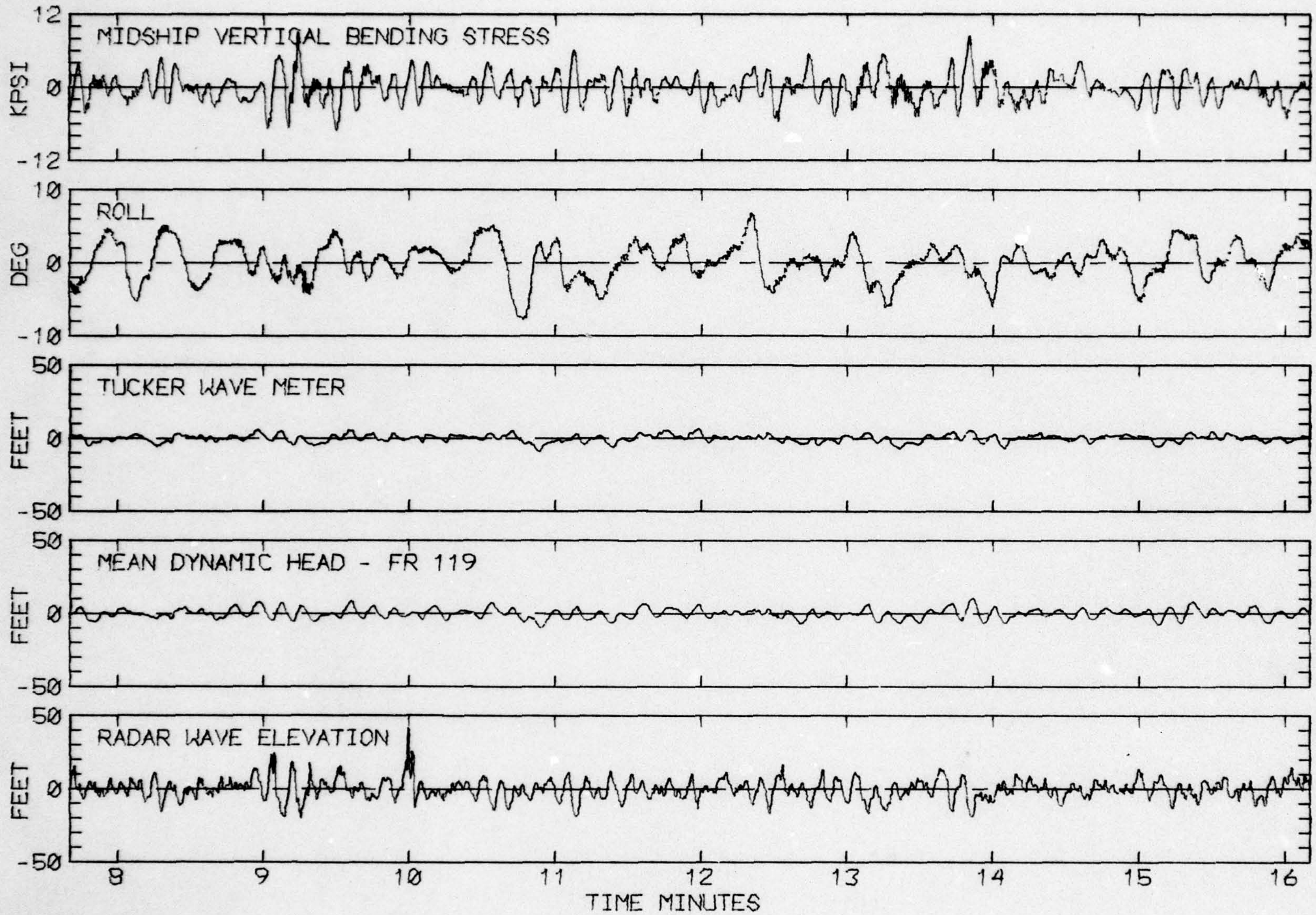
ROLL	10.1 DEG
PITCH	2.06 DEG
DK HSE VERT ACCEL	0.47 G
DK HSE LAT ACCEL	0.23 G
RADAR SLANT RANGE	43.1 FEET
VERTICAL RANGE	39.9 FEET
DISPL AT RADAR	27.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER	/DYN. HEAD	/RADAR
P-T SAMPLE SIZE	145	112	180
MAXIMUM HEIGHT	14.3	17.0	53.9
10TH HIGHEST HTS	9.2	12.6	31.4
3RD HIGHEST HTS	6.7	10.6	22.7
4.0 RMS(SPECTRA)	9.4	12.0	25.5



RUN 1309 -- VOYAGE 34W -- TAPE 163 -- INDEX 15 -- INTERVAL 9



RUN 1309 -- VOYAGE 34W -- TAPE 163 -- INDEX 15 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	02-08-74 1200
POSITION	48-09 N 47-18 W
COURSE AND SPEED	243 . 31.4 KNOTS
SEA STATE	2
WAVE HEIGHT	5 FEET
" REL DIR	49 STBD
SWELL HEIGHT	8 FEET
" REL DIR	27 STBD

---- VISUAL WEATHER / COMMENTS ----

CLEAR FOG SNOW /

MIDSHIP VERTICAL BENDING STRESS

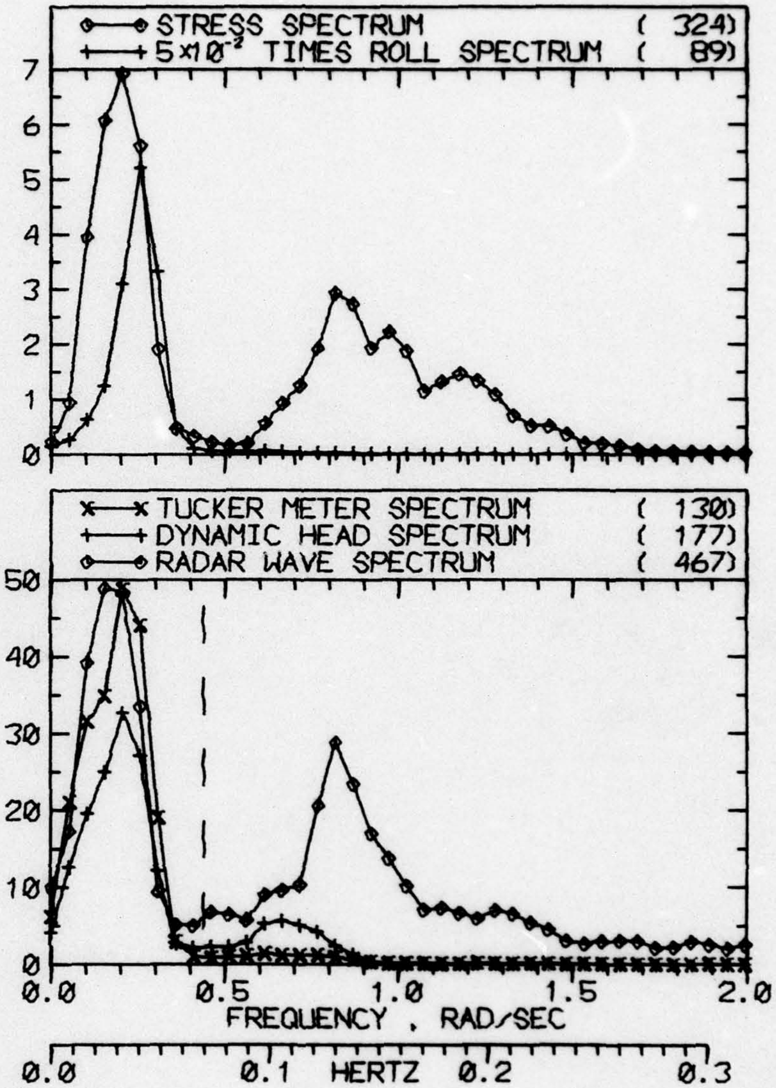
MAXIMUM PK-TR	9.3 KPSI
4.0 X RMS	6.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

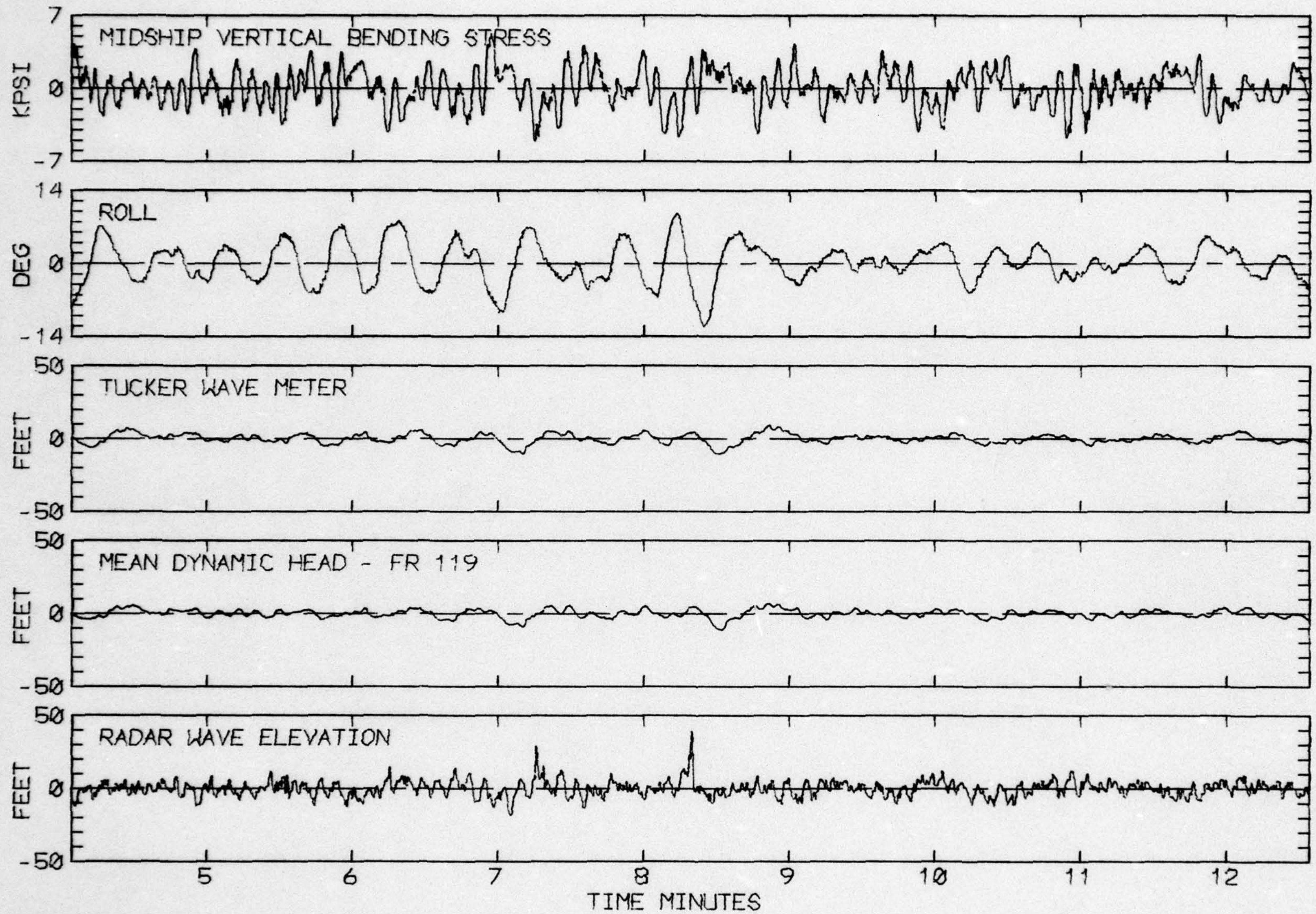
ROLL	15.7 DEG
PITCH	1.33 DEG
DK HSE VERT ACCEL	0.30 G
DK HSE LAT ACCEL	0.35 G
RADAR SLANT RANGE	40.2 FEET
VERTICAL RANGE	27.6 FEET
DISPL AT RADAR	15.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	75	87	236
MAXIMUM HEIGHT	15.9	16.1	42.2
10TH HIGHEST HTS	12.6	11.4	20.3
3RD HIGHEST HTS	9.1	8.3	15.0
4.0 RMS(SPECTRA)	13.4	11.8	20.4



RUN 1317 -- VOYAGE 34W -- TAPE 163 -- INDEX 17 -- INTERVAL 17



RUN 1317 -- VOYAGE 34W -- TAPE 163 -- INDEX 17 -- INTERVAL 17

LOG BOOK DATA

DATE AND TIME	02-08-74 1600
POSITION	48-09 N 47-18 W
COURSE AND SPEED	245 , 31.8 KNOTS
SEA STATE	4
WAVE HEIGHT	0 FEET
" REL DIR	47 STBD
SWELL HEIGHT	15 FEET
" REL DIR	25 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST SNOW /ICE FIELD ROLLING HIGH SWELL

MIDSHIP VERTICAL BENDING STRESS

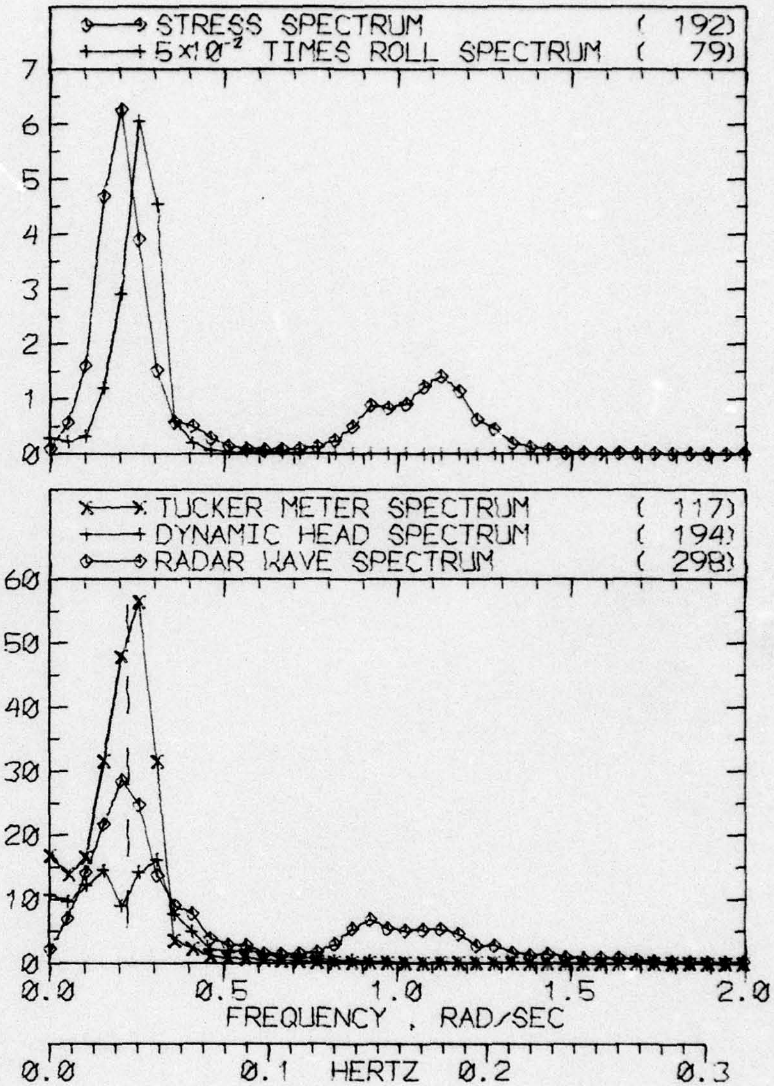
MAXIMUM PK-TR	8.3 KPSI
4.0 X RMS	4.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

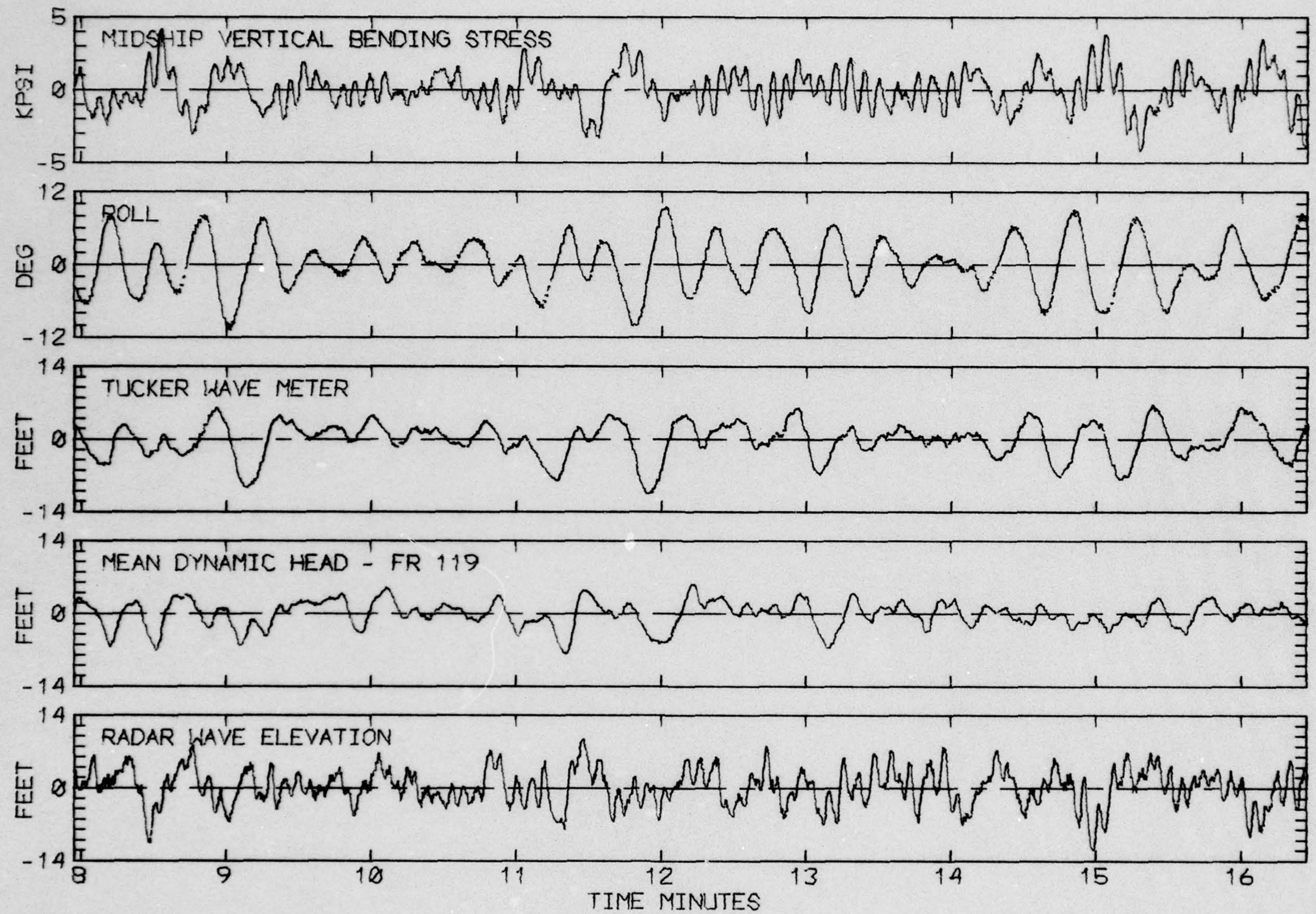
ROLL	16.4 DEG
PITCH	0.69 DEG
DK HSE VERT ACCEL	0.15 G
DK HSE LAT ACCEL	0.36 G
RADAR SLANT RANGE	33.2 FEET
VERTICAL RANGE	16.1 FEET
DISPL AT RADAR	13.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	76	95	167
MAXIMUM HEIGHT	16.1	10.8	16.3
10TH HIGHEST HTS	14.1	8.6	12.4
3RD HIGHEST HTS	9.8	6.1	9.5
4.0 RMS(SPECTRA)	13.3	9.3	12.9



RUN 1321 -- VOYAGE 34W -- TAPE 163 -- INDEX 18 -- INTERVAL 21



RUN 1321 -- VOYAGE 34W -- TAPE 163 -- INDEX 18 -- INTERVAL 21

LOG BOOK DATA

DATE AND TIME	02-08-74 2400
POSITION	48-09 N 47-18 W
COURSE AND SPEED	245 , 31.3 KNOTS
SEA STATE	6
WAVE HEIGHT	2 FEET
" REL DIR	92 STBD
SWELL HEIGHT	5 FEET
" REL DIR	25 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

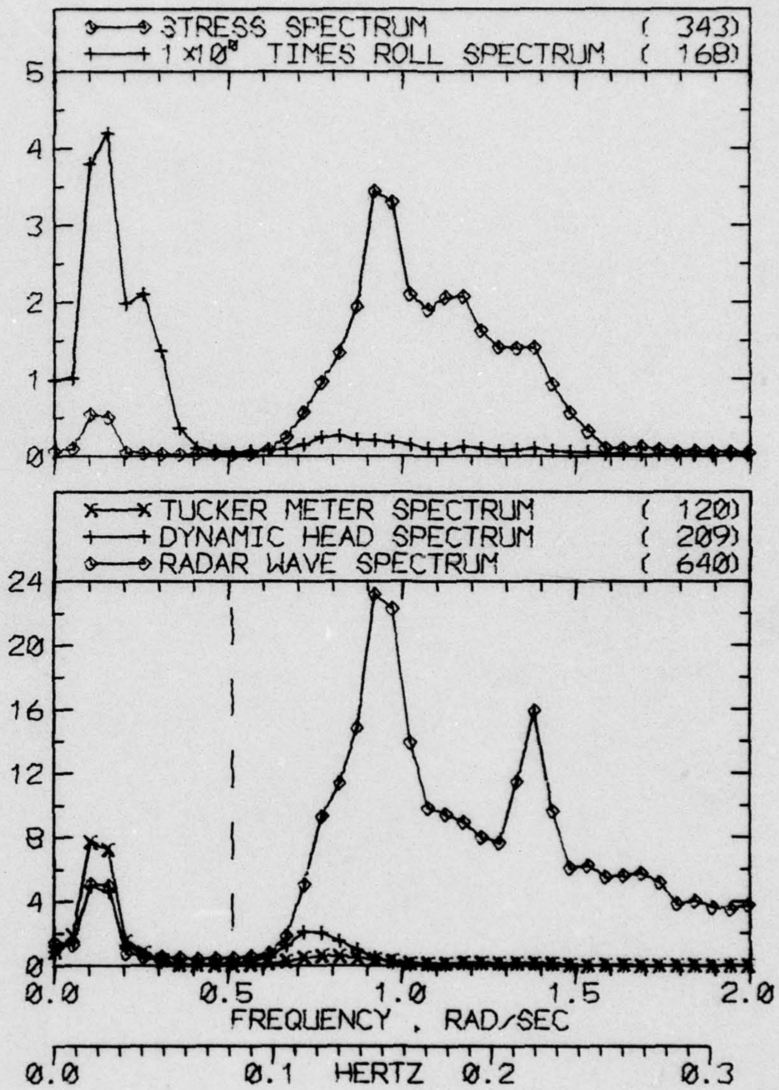
MAXIMUM PK-TR	8.3 KPSI
4.0 X RMS	5.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

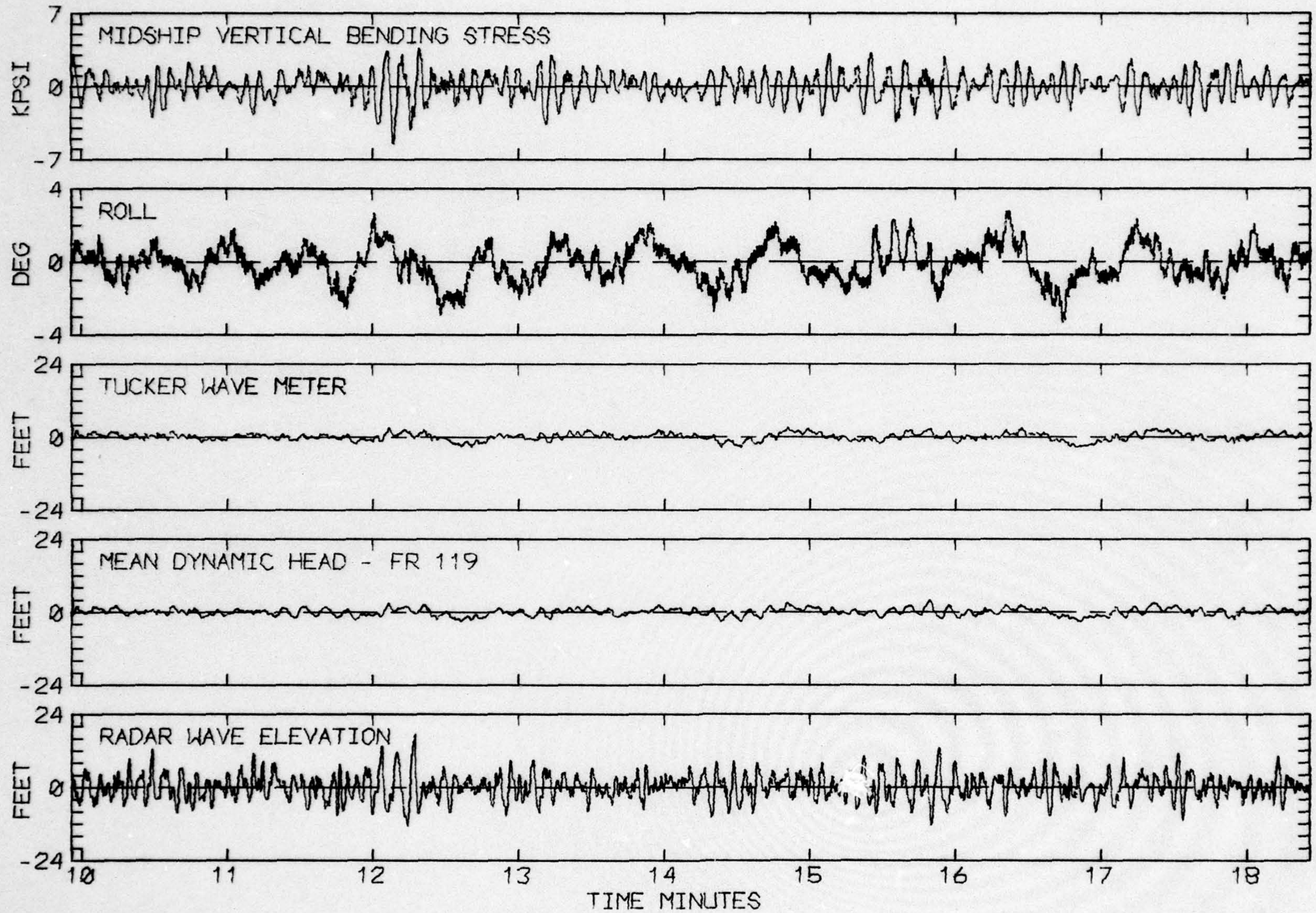
ROLL	4.0 DEG
PITCH	1.20 DEG
DK HSE VERT ACCEL	0.28 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	25.3 FEET
VERTICAL RANGE	22.5 FEET
DISPL AT RADAR	10.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	224	198	290
MAXIMUM HEIGHT	6.4	5.8	26.9
10TH HIGHEST HTS	3.6	4.0	18.3
3RD HIGHEST HTS	2.6	3.1	14.6
4.0 RMS(SPECTRA)	4.7	4.6	15.9



RUN 1329 -- VOYAGE 34W -- TAPE 163 -- INDEX 20 -- INTERVAL 29



RUN 1329 -- VOYAGE 34W -- TAPE 163 -- INDEX 20 -- INTERVAL 29

LOG BOOK DATA	
DATE AND TIME	02-09-74 0400
POSITION	48-09 N 47-18 W
COURSE AND SPEED	240 , 31.4 KNOTS
SEA STATE	5
WAVE HEIGHT	2 FEET
" REL DIR	75 STBD
SWELL HEIGHT	5 FEET
" REL DIR	30 STBD

---- VISUAL WEATHER / COMMENTS ----

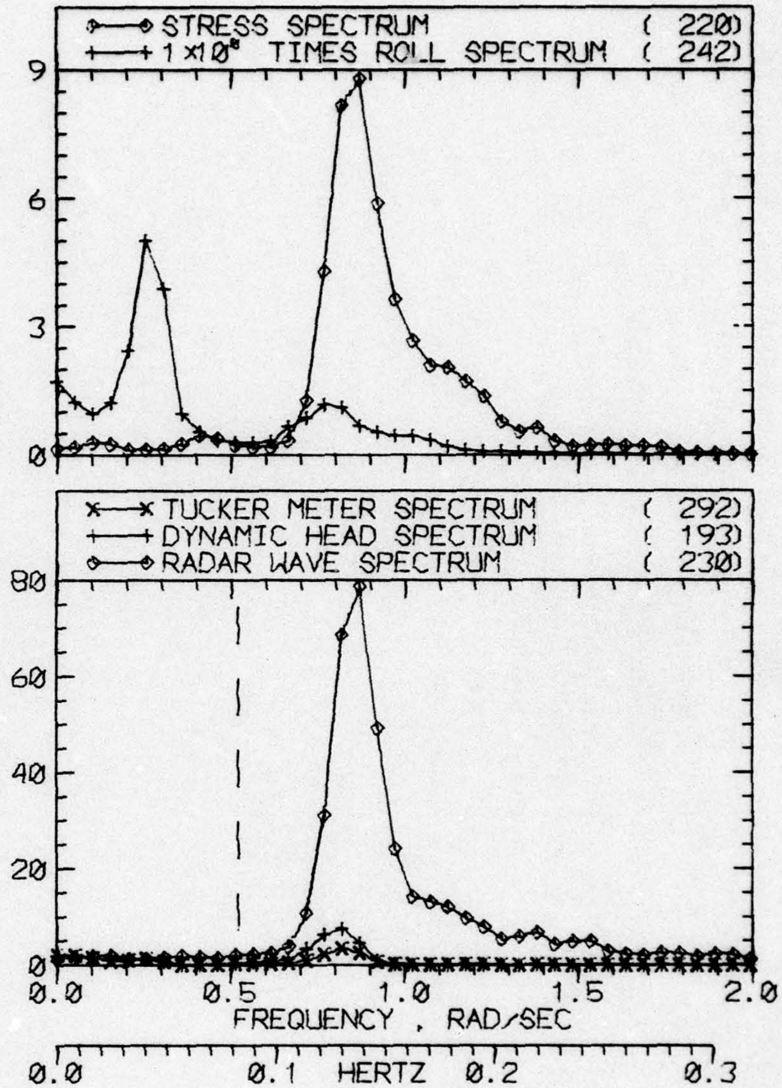
OCAST /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	10.5 KPSI
4.0 X RMS	6.5 KPSI

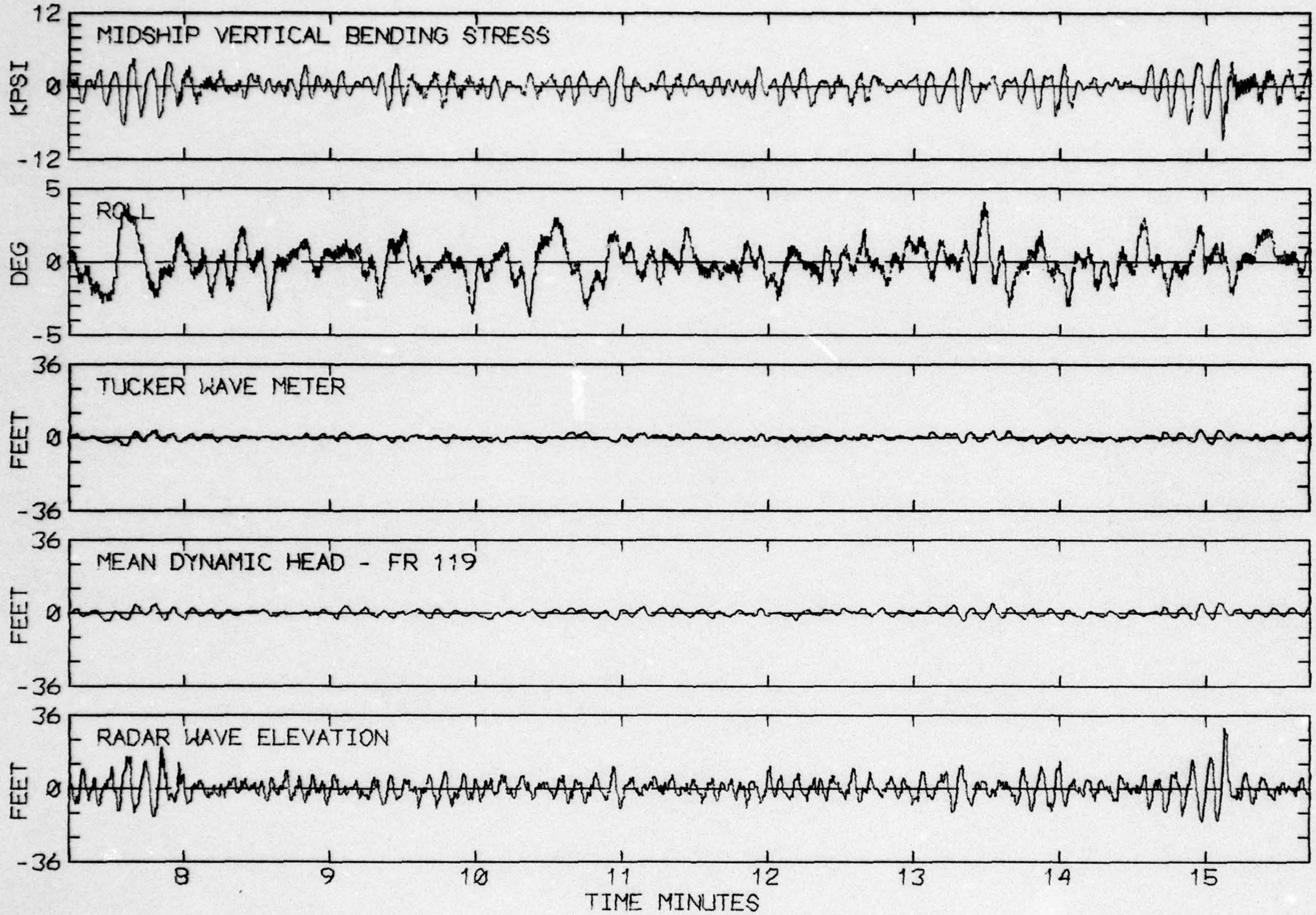
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	4.7 DEG
PITCH	1.76 DEG
DK HSE VERT ACCEL	0.41 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	35.1 FEET
VERTICAL RANGE	33.1 FEET
DISPL AT RADAR	19.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	255	184	238
MAXIMUM HEIGHT	6.8	7.8	36.2
10TH HIGHEST HTS	4.3	6.0	24.5
3RD HIGHEST HTS	3.2	4.7	17.5
4.0 RMS(SPECTRA)	4.4	5.5	18.7



RUN 1333 -- VOYAGE 34W -- TAPE 163 -- INDEX 21 -- INTERVAL 33



RUN 1333 -- VOYAGE 34W -- TAPE 163 -- INDEX 21 -- INTERVAL 33

LOG BOOK DATA	
DATE AND TIME	02-09-74 0800
POSITION	48-09 N 47-18 W
COURSE AND SPEED	246 , 31.8 KNOTS
SEA STATE	5
WAVE HEIGHT	2 FEET
" REL DIR	159 STBD
SWELL HEIGHT	5 FEET
" REL DIR	24 STBD

---- VISUAL WEATHER / COMMENTS ----

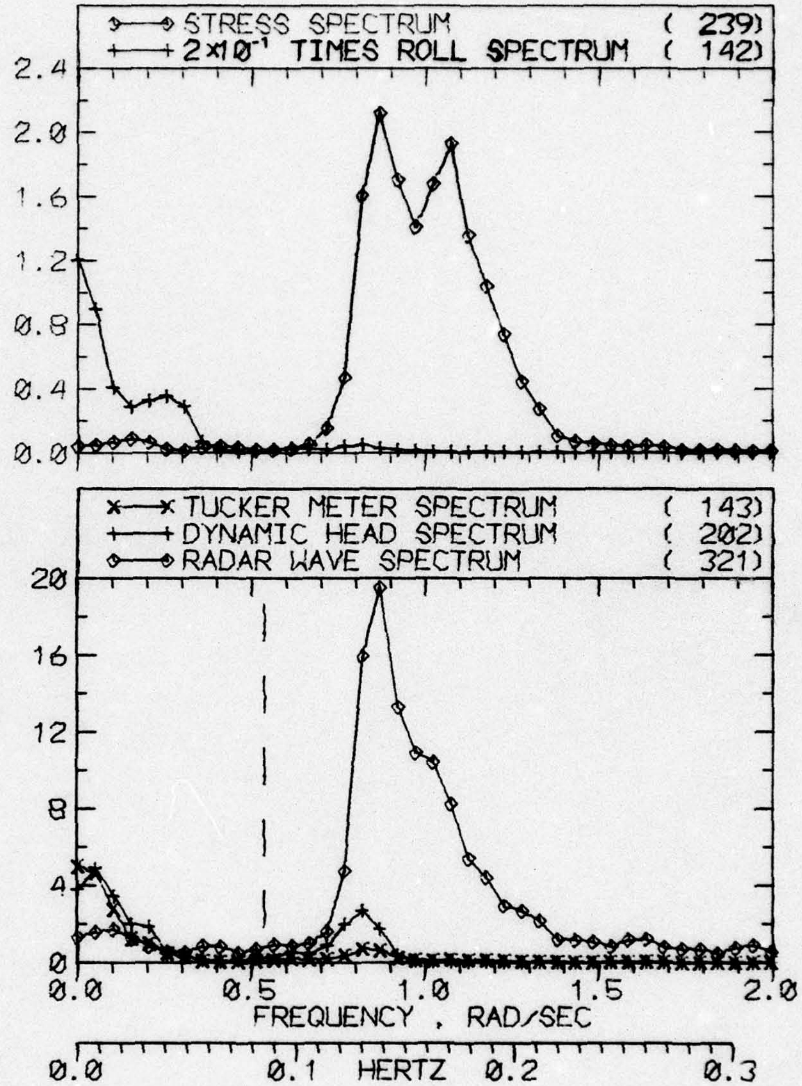
OCAST SNOW /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	5.4 KPSI
4.0 X RMS	3.7 KPSI

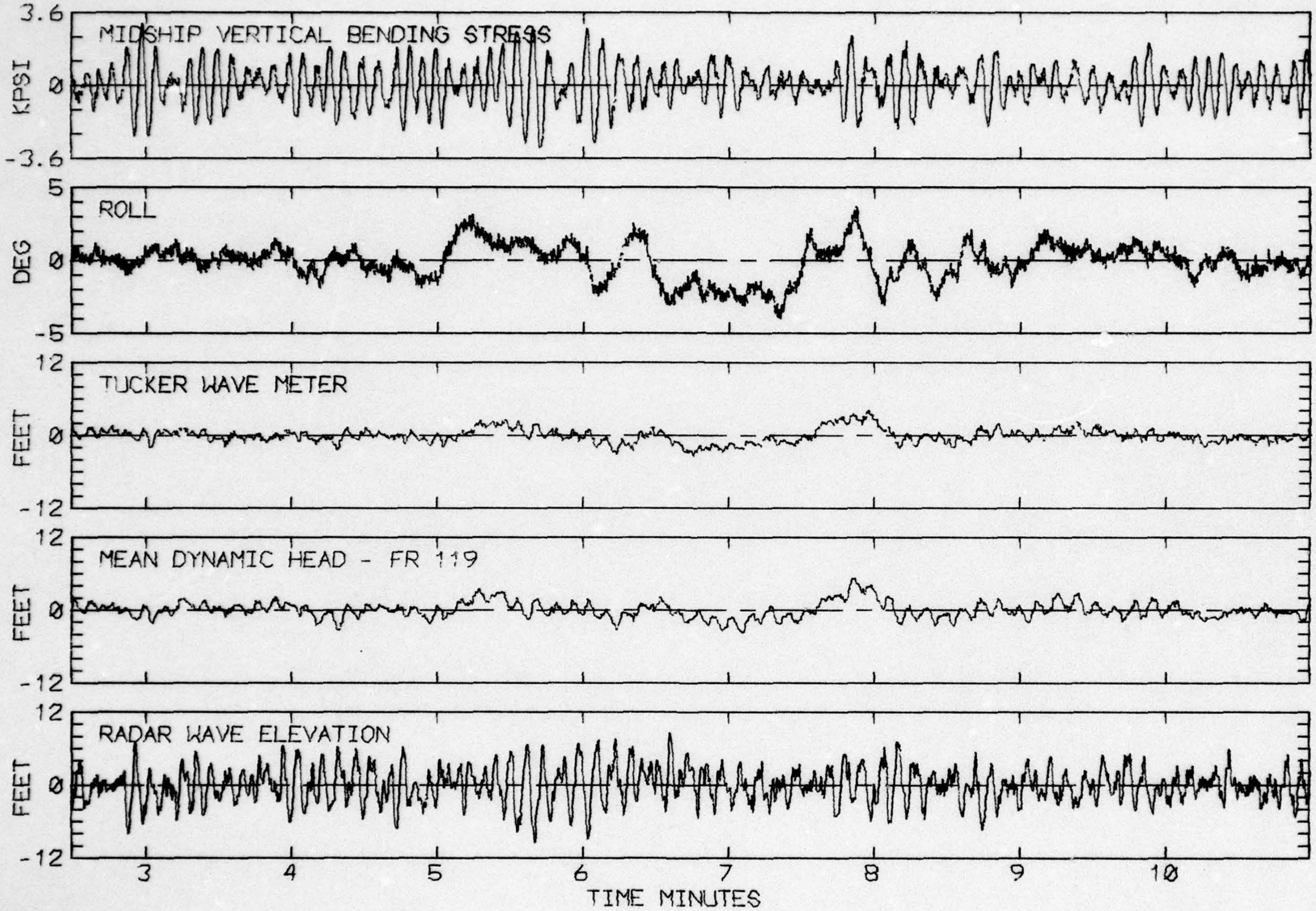
SUMMARY OF MOTIONS (4.0 X RMS)	
ROLL	4.0 DEG
PITCH	1.01 DEG
DK HSE VERT ACCEL	0.23 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	19.0 FEET
VERTICAL RANGE	17.3 FEET
DISPL AT RADAR	9.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/	DYN. HEAD/	RADAR
P-T SAMPLE SIZE	333	201	297
MAXIMUM HEIGHT	6.2	7.8	16.4
10TH HIGHEST HTS	2.6	3.8	11.6
3RD HIGHEST HTS	1.8	2.9	8.7
4.0 RMS(SPECTRA)	3.8	4.6	10.7



RUN 1337 -- VOYAGE 34W -- TAPE 163 -- INDEX 22 -- INTERVAL 37



RUN 1337 -- VOYAGE 34W -- TAPE 163 -- INDEX 22 -- INTERVAL 37

LOG BOOK DATA	
DATE AND TIME	02-09-74 1200
POSITION	42-32 N 63-16 W
COURSE AND SPEED	245 , 32.1 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	137 STBD
SWELL HEIGHT	3 FEET
" REL DIR	25 STBD

---- VISUAL WEATHER / COMMENTS ----

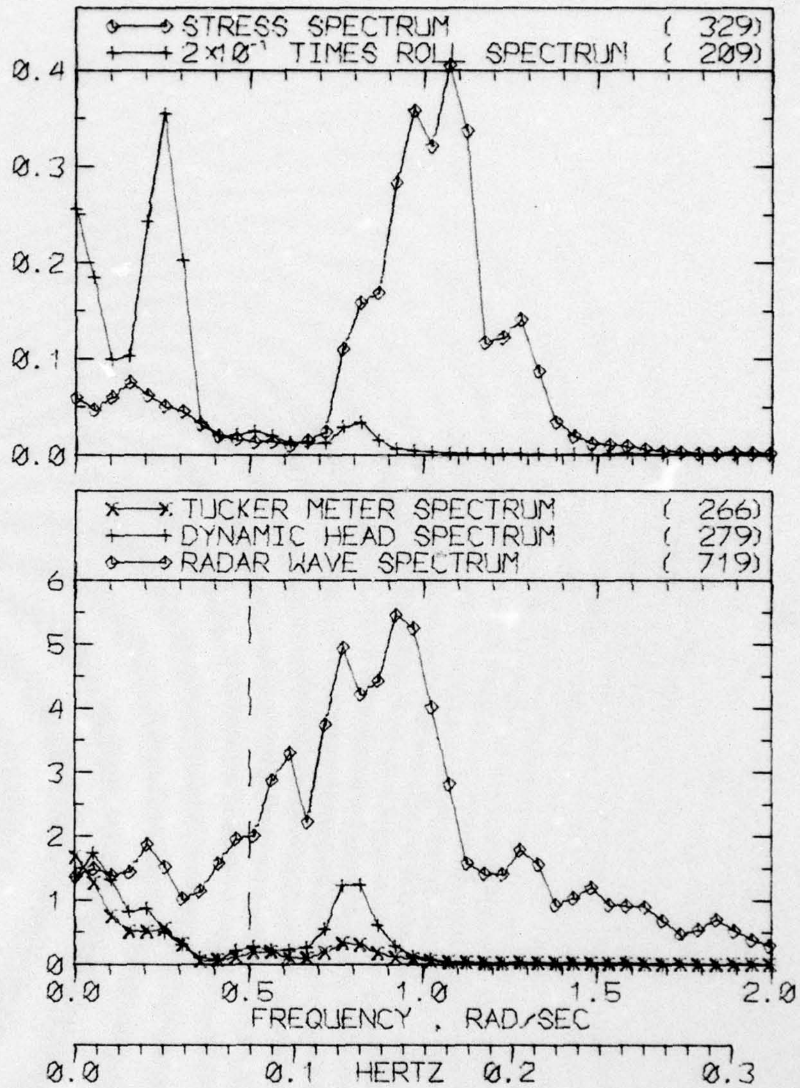
OCAST SNOW /

MIDSHIP VERTICAL BENDING STRESS	
MAXIMUM PK-TR	2.9 KPSI
4.0 X RMS	1.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)		
ROLL	2.8	DEG
PITCH	0.66	DEG
DK HSE VERT ACCEL	0.12	G
DK HSE LAT ACCEL	0.07	G
RADAR SLANT RANGE	11.0	FEET
VERTICAL RANGE	10.2	FEET
DISPL AT RADAR	5.1	FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	410	254	358
MAXIMUM HEIGHT	2.9	3.8	15.6
10TH HIGHEST HTS	2.0	2.9	9.6
3RD HIGHEST HTS	1.5	2.1	6.8
4.0 RMS(SPECTRA)	2.6	3.2	8.6



RUN 1341 -- VOYAGE 34W -- TAPE 163 -- INDEX 23 -- INTERVAL 41

AD-A057 156 STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB F/G 8/3
RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN VOYAGE 34.(U)
AUG 78 J F DALZELL N00024-74-C-5451

UNCLASSIFIED SIT-DL-77-1934 SSC-SL-7-18 NL

2 OF 2
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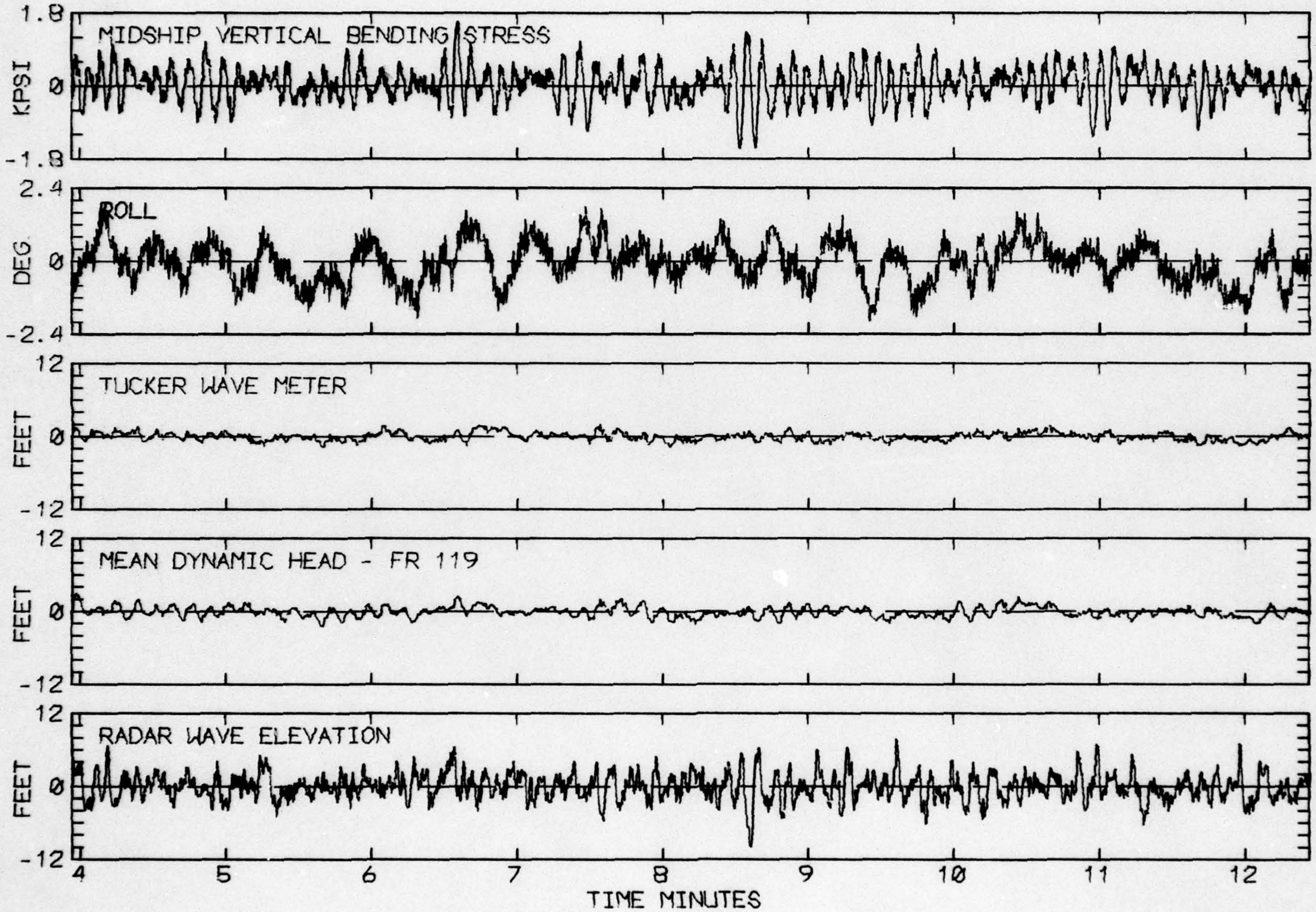


RUN 1341 -- VOYAGE 34W -- TAPE 163 -- INDEX 23 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	02-09-74 1600
POSITION	42-32 N 63-16 W
COURSE AND SPEED	245 , 32.1 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	137 STBD
SWELL HEIGHT	2 FEET
" REL DIR	160 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

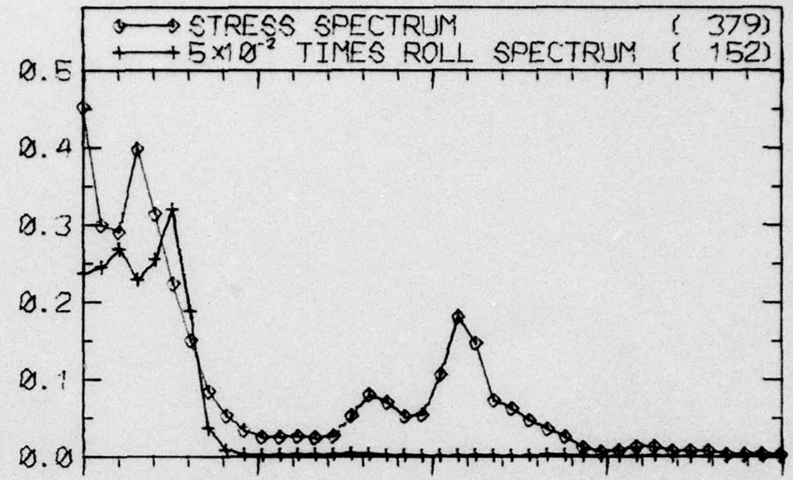
MAXIMUM PK-TR	1.8 KPSI
4.0 X RMS	1.7 KPSI

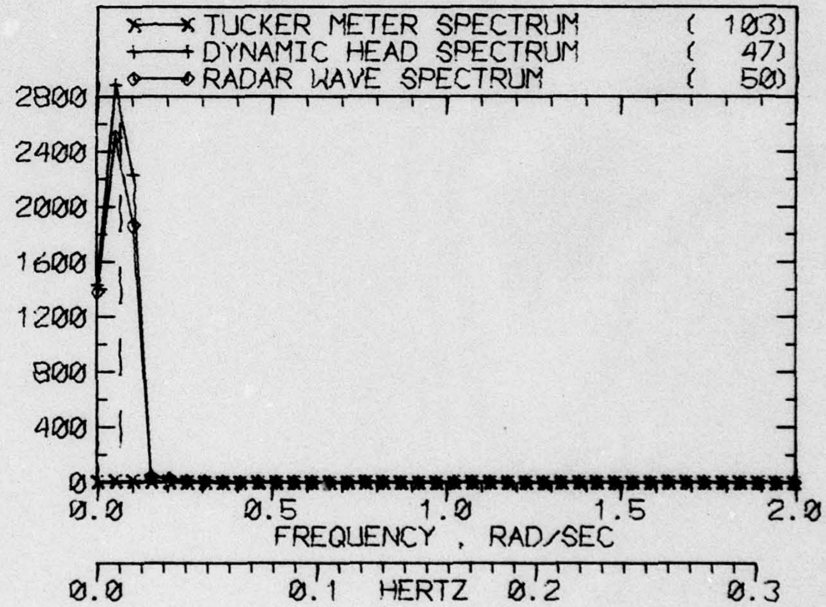
SUMMARY OF MOTIONS (4.0 X RMS)

ROLL	5.4 DEG
PITCH	0.64 DEG
DK HSE VERT ACCEL	0.07 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	12.0 FEET
VERTICAL RANGE	9.7 FEET
DISPL AT RADAR	64.4 FEET

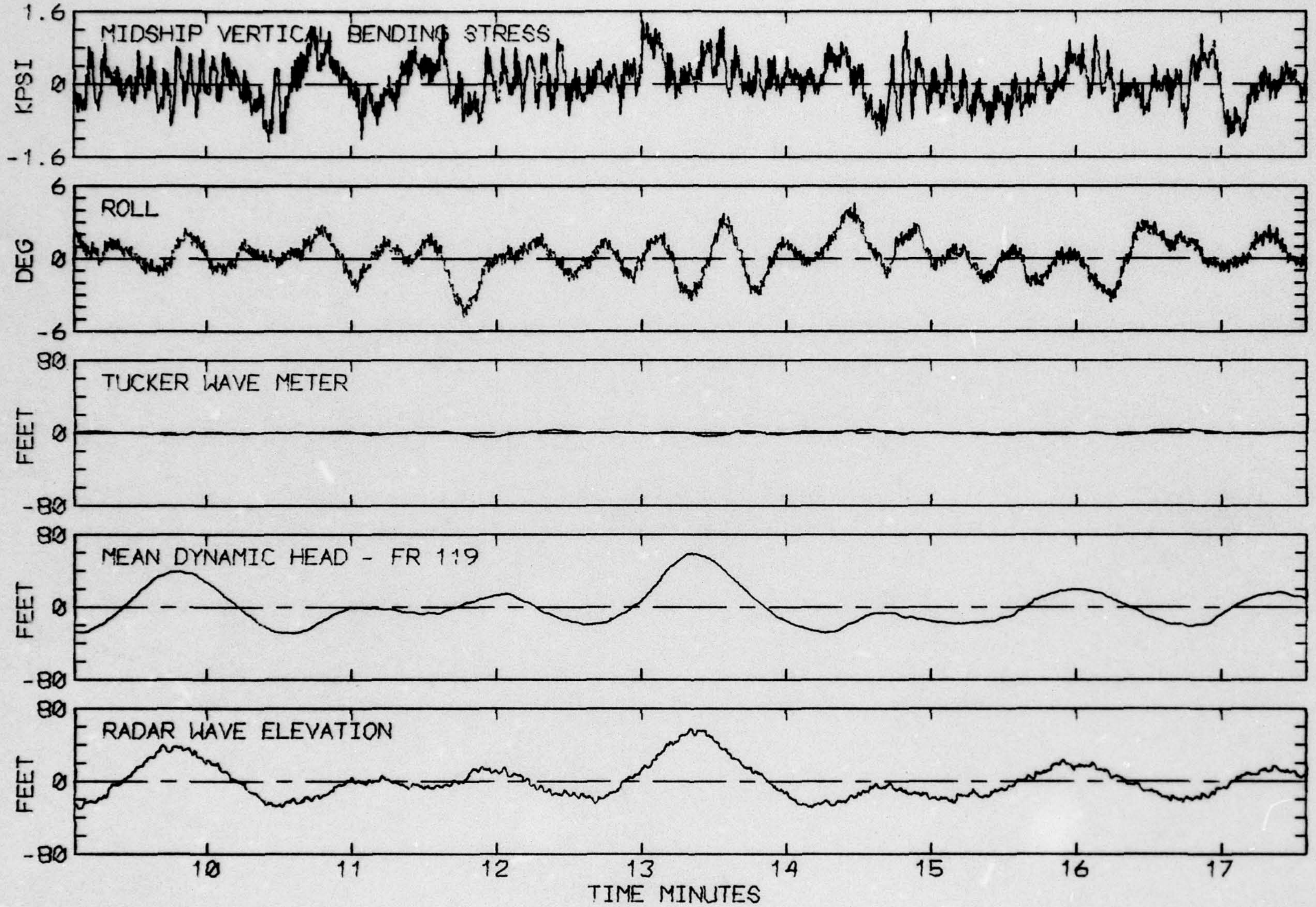
WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	193	14	48
MAXIMUM HEIGHT	5.6	87.2	87.0
10TH HIGHEST HTS	3.2	77.8	51.1
3RD HIGHEST HTS	1.8	53.9	27.5
4.0 RMS(SPECTRA)	5.7	69.1	65.3





RUN 1345 -- VOYAGE 34W -- TAPE 163 -- INDEX 24 -- INTERVAL 45



RUN 1345 -- VOYAGE 34W -- TAPE 163 -- INDEX 24 -- INTERVAL 45

APPENDIX

THE DATA REDUCTION AND PRESENTATION PROCEDURE ACCORDING TO THE DEVELOPMENT IN REFERENCE 4

The data reduction procedure for each interval involved:

a. Four main computation programs, the last one of which produced a complete file of results for each interval.

b. Two lister programs to supply immediate indications of some of the results.

c. One file consolidation program which produced one file for each voyage leg containing everything but the time histories of radar wave and mean dynamic head.

d. Two programs to generate the final graphical presentations for each interval.

Items b through d amount to bookkeeping operations. The work was done in the four main computation programs.

The first computation program carried out the procedure described in Reference 4 for the radar. At its conclusion the radar wave spectrum and the computed time history were written in temporary files as was the time history of vertical displacement at the radar.

The second program involved reduction of the Tucker data. Both the original data and the displacement file produced by the first program were accessed. The procedure was carried out so that time histories of mean dynamic head and the Tucker Meter signal were available. These were spectrum analyzed, and all results written in a temporary file.

The third computation program accessed the various wave-related time histories (radar, Tucker, and mean dynamic head) and performed a peak-trough analysis on the middle 16-1/2 minutes of each. (Because of the tapering described in Reference 4 both the radar and mean dynamic head data are not valid for the first and last two minutes of sample.) The object of the peak-trough analysis was to produce double amplitude statistics. The zero crossing convention was used; that is, a crest was defined as the largest instantaneous value in an excursion above the sample mean, a trough was the smallest instantaneous value in an excursion below the sample mean. The double amplitude is the difference in elevation between crest and succeeding trough. In this approach small fluctuations are more or less ignored if they are riding on top of large ones. The results resemble the double amplitudes which would be estimated by hand from an oscillograph record except that the hand analyst would probably visually fair through superimposed noise whereas the computer does not. The effect is that while the computer gets about the same number of double amplitudes as the human analyst, the computer's answers tend to be higher if the records are noisy. From the double amplitudes found, the average of 1/3 and 1/10 highest were computed, and the position in the sample of the largest double amplitude was noted. All results, including the actual double amplitudes were written in a temporary file.

The fourth computation program accessed the original data and performed spectrum analyses upon the midship vertical bending stress and roll. It then accessed all previously written temporary files and produced a new file containing all of the results for the interval. These results included log-book data, results of the first analysis of raw data (Ref.3,5), five spectra along with all analysis parameters, all results from the peak-trough analysis, and the two new time histories, the radar wave and the mean dynamic head. These files were meant to be stored on magnetic tape for possible future reference.

The final presentation of results for each interval is contained on two charts. The first type of chart (which appears on the even numbered pages of this report) contains the scalar spectra and a tabulation of results. The second type of chart (odd numbered pages) involves sample time histories. Both are identified at the bottom with the DL run number, the voyage number, the analog tape and interval numbers, and the index number assigned by Teledyne.

Referring to any even page, the tabulation at the left is intended as a summary of the most significant numbers pertaining to the interval. At the top is as much of the original log-book data as it seemed reasonable to squeeze in. This includes date, time, position, and ship speed, as well as the visual estimates of wave and swell heights and directions. Directions are counted from the bow to port or starboard in degrees. The "sea state" is apparently the Beaufort wind. The final line in the first section of the tabulation includes comments on visual weather and, after the slash, any other comment appearing in the log.

The second box in the tabulation involves midship longitudinal stress results. Only two of the many numbers which are available could be included as indices. The first is the maximum peak to trough stress excursion as obtained in Reference 1 or 2. The second index is the significant stress (4 times rms) as derived from the area of the stress spectrum obtained in the present reduction.

The third box in the tabulation is a summary of motions. Again the "significant" motions (4 rms) are indicated. The value for roll was derived from spectrum area, that for pitch and accelerations from the rms of the basic data. (Unless there are significant linear trends in the data the differences are slight between "raw" and "spectrum" rms.) The last three items in the list involve various stages in the radar data reduction. The first is the slant range as recorded. The "vertical range is $R_c(t)$ of the radar analysis. This entry is essentially the vertical component of the range relative to the position of the accelerometer package. The number was derived from the spectrum. The last entry is the significant displacement at the radar (significant doubly integrated acceleration). It too was derived from spectrum analyses.

In a sense, the table at the bottom of the tabulation contains the final numerical answers. Items in the first column pertain to the uncorrected Tucker Meter signal. The second column pertains to the mean dynamic

head developed in conjunction with the analysis of the Tucker meter, and the third column pertains to wave elevations derived from the radar system. The first row in the table is the number of double amplitudes found in the middle 16-1/2 minutes of the sample. Below this are noted the maximum height found and the averages of the 1/10 and 1/3 highest double amplitudes. The final line in the table is the significant (4 rms) height derived from the spectral analyses. Ordinarily it is expected that the last two lines of the table will be about the same.

At the right of any even page are plots of the five computed spectra. It was decided to standardize the frequency scale from 0 to 2 rad/sec. In the great majority of intervals everything of interest is contained in this range. In some intervals one spectrum or another is non-negligible beyond 2 rad/sec but nothing much has been seen beyond 2.5 rad/sec for any of the quantities analyzed except in the stress spectrum where something may often be noticed around the frequency of the first mode of vertical vibration. The folding frequency of the analyses is above 20 rad/sec; no aliasing is expected, Reference 3.

The stress and roll spectra are plotted together. The vertical scale is for the stress spectrum. The roll spectrum has been multiplied by the factor noted in the legend before plotting. Dimensions of the stress spectral density are ($kpsi^2$/rad/sec) and those of the roll spectral density are (deg^2/rad/sec).

All three wave related spectra (Tucker, mean dynamic head, and radar) are plotted together to the same scale. The dimension of the wave spectral density is ($feet^2$/rad/sec). In the wave spectrum plot there is a vertical (slightly joggled) dashed line. This line marks the position of the low frequency cutoff, ω_o, discussed in Reference 4 in conjunction with double integration of the vertical accelerations. It is correct to interpret the position of this line as meaning that the double integration has been done correctly for higher frequencies, and incorrectly for lower frequencies.

There are several details about the spectrum analyses which are not documented in the plots because they are constant throughout the data reduction. First, the normalization of the spectra is such that the spectrum area equals variance. All spectra are derived from a Fast Fourier Transform analysis of an 8192 point sample. The fundamental results is 4096 spectral estimates of 2 degrees of freedom each. These estimates are uniformly spaced in frequency at a delta-frequency of 0.00511 rad/sec. In order to improve statistical reliability, the basic spectral estimates were averaged in blocks of 20 estimates at intervals of 10 estimates. The resulting averages are thus equi-speced on the frequency scale at intervals of $\Delta\omega$ = 0.0511 rad/sec. This also means that adjacent spectral estimates as shown in the plot are not quite independent -- to about the same degree as spectral estimates from the older autocorrelation methods are not independent.

As a result of the averaging, each spectral estimate has 40 degrees of freedom associated with it. Accordingly, the 90% confidence bounds on the spectra shown in the charts may be formed by multiplying the values given by 0.72 and 1.51. Had the process sampled continued indefinitely and a large number of 20.5 minute samples been obtained and analyzed, nine out of ten of these new estimates of spectral density would be expected to lie within the bounds so constructed. The practical implication is simply that the influence of sampling variability upon the given numerical results is roughly the same as that associated with the result of most other full scale wave measurement exercises.

The last detail of the spectrum analysis is the "total degrees of freedom." This number is included in parentheses at the end of each line of legend because it depends upon the shape of each individual spectrum. It is an estimate of the proper number of degrees of freedom to use in constructing confidence bounds on the sample variance. If each of the numbers in the present 8192 point time histories had been picked randomly the "total degrees of freedom" would be 8191. This is not the case -- adjacent members of all the present time series are highly correlated so that the equivalent "random" sample size is much smaller. In the present data set the "total degrees of freedom" (TDF) is expected to vary between 60 and 600. Approximate 90% confidence bounds on the variances assuming a Normal zero mean process, may be constructed by multiplying the estimate by two factors derived from the percentage points of the Chi-square distribution. Examples of the values of these factors are given as follows:

TDF	Factor for Lower Bound	Factor for High Bound
60	.72	1.32
120	.80	1.27
200	.84	1.17
400	.89	1.12
600	.91	1.10

These are factors for the variances. The square root applies to the rms values so that very roughly the 90% confidence bounds on rms range from the sample rms ± 15% for TDF = 60 to the sample rms ± 5% for TDF = 600. The practical implications of these results are quite similar to those mentioned in connection with the confidence bounds on the spectra. There is only so much "precision" obtainable from one 20 minute sample of wave elevation -- that which was attacined in the present work appears comparable to that achieved in the past in similar studies. With respect to comparisons between wave meters or between data and predictions of rms ship responses there can be little justification to a concern about differences of 5 to 15% magnitude.

The sample time histories on the odd numbered pages need little explanation, except perhaps to say that the duration of the sample shown (8-1/2 minutes) was a compromise between a desire to display as much of

the 16-1/2 minutes of derived wave time histories as was possible in one page; and the desire to spread the time scale out so that individual fluctuations were visible for intervals involving high ship speed in head seas. To produce the charts an 8-1/2 minute portion of the available 16-1/2 minutes of sample was chosen such that the largest radar wave double amplitude is shown -- as well as (if possible) the largest mean dynamic head double amplitude.

It may be fairly asked why the effort in producing plotted time histories for each interval was considered worthwhile. The answer to the question is fairly simple. While the present data in its original analog form has been scanned systematically by eye, the process involved oscillograph records with a time scale of about 15 minutes to the inch. At this time compression only a gross idea of what was happening can be formed, no detailed assessment of the believability of the data can be made, and, most importantly, the odd malfunction which is enough to upset the spectrum estimates or the statistics may often go unnoticed. This last is considered most important in the radar data. It was pointed out in References 3 and 5 that an attempt was made to weed out intervals where the radar had evidently lost signal and re-established a new reference range. In this process only the most obvious instances could be identified; no guarantees could be made that all instances of moderate or small magnitude had been eliminated.

REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: SL-7-18
2. GOVT ACCESSION NO.:
3. RECIPIENT'S CATALOG NUMBER:
4. TITLE (and Subtitle): RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND McLEAN - VOYAGE 34
5. TYPE OF REPORT & PERIOD COVERED: Technical
6. PERFORMING ORG. REPORT NUMBER: SIT-DL-77-1934
7. AUTHOR(s): J. F. DALZELL
8. CONTRACT OR GRANT NUMBER(s): N00024-74-C-5451
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Stevens Institute of Technology, Hoboken, N.J.
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: SF-422-703-06, Task 17593 - SR-1221
11. CONTROLLING OFFICE NAME AND ADDRESS: Department of the Navy, Naval Sea Systems Command, Washington, D.C. 20362
12. REPORT DATE: August 1978
13. NUMBER OF PAGES: 98
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): Ship Structure Committee, U.S. Coast Guard Headquarters, Washington, D.C. 20590
15. SECURITY CLASS. (of this report): UNCLASSIFIED
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:
16. DISTRIBUTION STATEMENT (of this Report): UNLIMITED

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report): UNLIMITED

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

18. SUPPLEMENTARY NOTES:
19. KEY WORDS (Continue on reverse side if necessary and identify by block number):

99

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Second Season Voyage 34.

METRIC CONVERSION FACTORS

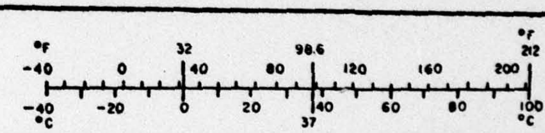
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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SL-7-1, (SSC-238) - *Design and Installation of a Ship Response Instrumentation System Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN* by R. A. Fain. 1974. AD 780090.

SL-7-2, (SSC-239) - *Wave Loads in a Model of the SL-7 Containership Running at Oblique Headings in Regular Waves* by J. F. Dalzell and M. J. Chiocco. 1974. AD 780065.

SL-7-3, (SSC-243) - *Structural Analysis of SL-7 Containership Under Combined Loading of Vertical, Lateral and Torsional Moments Using Finite Element Techniques* by A. M. Elbatouti, D. Liu, and H. Y. Jan. 1974. AD-A002620.

SL-7-4, (SSC-246) - *Theoretical Estimates of Wave Loads on the SL-7 Containership in Regular and Irregular Seas* by P. Kaplan, T. P. Sargent, and J. Cilmi. 1974. AD-A004554.

SL-7-5, (SSC-257) - *SL-7 Instrumentation Program Background and Research Plan* by W. J. Siekierka, R. A. Johnson, and CDR C. S. Loosmore, USCG. 1976. AD-A021337.

SL-7-6, (SSC-259) - *Verification of the Rigid Vinyl Modeling Techniques: The SL-7 Structure* by J. L. Rodd. 1976. AD-A025717.

SL-7-7, (SSC-263) - *Static Structural Calibration of Ship Response Instrumentation System Aboard the SEA-LAND McLEAN* by R. R. Boentgen and J. W. Wheaton. 1976. AD-A031527.

SL-7-8, (SSC-264) - *First Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service* by R. R. Boentgen, R. A. Fain, and J. W. Wheaton. 1976. AD-A039752.

SL-7-9, *Second Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S. S. SEA-LAND McLEAN in North Atlantic Service* by J. W. Wheaton and R. R. Boentgen. 1976. AD-A034162.

SL-7-10, *Third Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S. S. SEA-LAND McLEAN in North Atlantic Service* by R. R. Boentgen. 1976. AD-A034175.

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SL-7-14, (SSC-277) - *Original Radar and Standard Tucker Wavemeter SL-7 Containership Data Reduction and Correlation Sample* by J. F. Dalzell. 1978.

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SL-7-17, *Radar and Tucker Wavemeter Data from S. S. SEA-LAND McLEAN - Voyage 33* by J. F. Dalzell. 1978.

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